July 1990 Vol. 3 Nº 10 Price £2.00

Archive

The Subscription Magazine for Archimedes Users

Acorn's new ARM3 Machines

Optimising 'C' Programs

A310 Memory Upgrades Compared

Using the PC Emulator – Part 3

Introduction to 'C' – Part 8

Reviews: Atomwide's VIDC Enhancer, Bug Hunter + Moon Dash, Stylus – Primary WP, Apocalypse, Arcade Soccer.

A trip down Memory Lane

I well remember in July 1980, climbing up a winding staircase at 4A Market Hill to buy a kit for my first Acorn computer – an Acorn Atom. It had an operating system plus BASIC in two 8k EPROM's and its RAM consisted of two 1k chips. It used a 1MHz, 8-bit 6502 microprocessor.

In July 1987, I went down to Cambridge again, this time to look at Acorn's latest offering which had a 32-bit processor running at eight times the speed with operating system plus BASIC in ROMs occupying 128 times as much space and with five hundred times as much RAM memory! It's not surprising I was impressed.

In July 1990, we are asking what has happened to Acorn's new operating system (which is twice as big as the first one – see page 4); A310 owners are saying that 1M of memory is far too little for many of the applications we want to run under RISC-OS (see page 47); we are talking about processors running four times as fast as the first Archimedes (see page 11); and we are introducing a new Acorn machine (which I don't think is all that revolutionary but see page 17) which, 10 years on, has 4,000 times the memory and runs 30 times as fast as my little Acorn Atom!

Would anyone like to hazard a guess what we will be talking about in Archive magazine in July 1993, let alone July 2000? I'm saying nothing!

Yours, in eager anticipation,

Government Health Warning – Reading this may seriously affect your spiritual health.

"How can a God of Love allow all this suffering we see in the world today?" You wouldn't believe the number of times I've been asked that question. I don't pretend that there are any easy answers but, in any case, I don't think it is the most important question to get sorted out.

Yes, it **is** a tragedy when thousands of people are killed in an earthquake and, yes, it **is** a tragedy when innocent babies suffer through no fault of their own but let's stop and think about this for a minute. If you look at some of the awful things going on in the world around us and think about some of the things that have caused us most pain, personally, what is the root cause? The main problem is with human relationships – you know as well as I do that, in a family situation, most of the fights that take place are caused by selfishness – I want something and I can't get it, so I fight for it. (Is your family any different from mine?) Isn't exactly the same thing true on a wider scale? Whether it is unions and bosses or political groups or nations, it's 'I want something and I can't get it, so I fight for it'. Oh yes, we put it in more sophisticated language by talking about 'rights' and 'justice' but it often boils down to the same thing in the end.

But let's be more positive. What are the things that really make life worth living? Is it making lots of money, owning a super fast car? (a faster Archimedes?!) No, you're not fooled by the adverts any more than I am. Real joy comes from deep friendships and (in the original sense of the word) love between individuals. I believe (arrogantly, some would say) that I have found the secret for achieving this.

Now, I know it's not the sort of thing that we reserved English people do, but if you would like to know what the secret is, drop me a line – I'd love to share it with you. Or you could try reading the bible – that's where I found the secret – it's no wonder they call it 'Good News'!

Archive

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Contents

Archive magazine is edited by Paul Beverley and published by Norwich Computer Services.

Products Available

• **1M / 4M upgrades for A3000** – Atomwide are getting into the A3000 memory upgrade market. They are doing a bare p.c.b. (costing £35 through Archive) which has eight sockets into which you plug the memory chips. If you want a 1M upgrade, you use a standard 410/1 memory upgrade (£70 through Archive). The Archive price for a populated 1M board is £100. If you want to make a 4M upgrade, you use the larger 4M by 1 bit chips (HM514400ZP–8) instead of the 1M bit chips. At the moment, these are about £350 for a set of eight but the price is dropping. So, the current Archive prices are £100 for the 1M upgrade and £375 for the upgrade to 4M. (The prices of the Morley upgrades are currently £105 and £285 but note that the Atomwide boards are 4 layer boards and only have 8 chips compared to the Morley's 24 chips. This reduces the current consumption and comes closer to Acorn's tight specifications for memory upgrades.) If you buy the 1M Atomwide board from us and then wish to upgrade, simply return the board and we will exchange the chips at the current rate. Remembering that the prices of both sets of chips are still falling, it would be worth contacting us before either ordering a 4M board or sending a 1M board for upgrading.

• **A3000 ram prices down again** – The Morley A3000 ram boards are now down to £105 and £285 for the 1M and 3M boards respectively.

• **A3000 SCSI drives** – Due to over-stocking, we have a few 20M and 80M Oak A3000 SCSI drives with podule at very special prices of £520 and £920 respectively. The normal Archive prices are £560 and £970, and the Oak prices are £615 and £1100. (Please ring before ordering to check availability.)

• **A310 upgrades** from Computerware are down in price a little: £370 and £575 through Archive for the 2M and 4M respectively. Those prices include fitting by Computerware themselves; they include collection and return delivery by over-night carrier and a free MEMC1a upgrade (normal price £74).

• **A310 memory upgrades** – D.I.Y. A310 memory upgrades from Protokote Ltd are now available. The 1M boards are £345 +VAT and 3M boards are £510 +VAT. (£375 and £570 respectively through Archive.) They, too, will take the larger OS ROMs (if they ever appear!) though it does require track cutting and soldering to implement it which should only be done by an Acorn Component-level Service Centre. Also, it looks as if it would not be possible to fit an ARM3 upgrade with it, unlike the Computerware one. You don't actually need to fit a MEMC1a to get either upgrade working, but it is our opinion that fitting either memory upgrade will shorten the life of the old type MEMC's.

• **Acom** – A full multi-tasking comms package for only £29.95 (inc VAT) from ECD in Delft, Holland. (£28 through Archive) It has various terminal emulations: rawVDU, ANSI, Viewdata, VT52, VT100 and VT220 as well as a Viewdata editor. (See Comment Column for more details.)

• **Another new monitor** – We have now added the Eizo16" colour multi-sync (9070SZ) to our list of monitors (£880 including a free VIDC enhancer). It is very similar to the 9060SZ (14" – £520), so is the extra 2" worth the extra cost? Well, having actually used it, I would say it certainly is. In fact, if you were thinking of getting an Oak 20" monitor (£1550) it would be well worth looking at the 9070 first since, at virtually half the price, it offers comparable resolution and takes up somewhat less desk space.

The 9070 is a standard IBM type monitor and can therefore also be used on computers other than the Archimedes whereas the 9060 comes specially adjusted to the Archimedes' output. If you try the 9070 on a standard Archimedes you will find that it does not work in anything other than the multi-sync modes but with the VIDC enhancer added to your computer it works in all the normal modes as well as the extra modes provided with the enhancer. You will find too that you can leave the enhancer switched on all the time as it even works in the lower modes with the higher VIDC clock speed. Mind you, you will have to switch the enhancer off for applications where the pitch of the sound is important since the enhancer raises the pitch somewhat. I am going to be using the 9070 for DTP work on the magazine in future, I think, rather than splashing out on an Oak 20".

• **ArVis video products** – Video Electronics Ltd have a range of video products for the Archimedes: ArVis video controller & genlock podule (£279 for PAL or £295 if SVHS is also required), Videographics expansion card (£877) for colour digitisation and framestore, ArVis PAL encoder (£139). Send to them for technical information or send them £5 for a demo disc. (All prices are exc VAT.)

• **Cheaper Joysticks** – Bulk buying of the Voltmace joysticks has enabled us to reduce the price from £28 to £25.

• **Computerware drives down in price** – The ST506 drives produced by Computerware are now almost as cheap as the (slower) Oak Computers' drives. See the Price List for details.

• **Escape from Exeria** is an escape from the caves game for just £2.95 from Soft Rock Software.

• **First Word Plus special deal** – We have ended up with rather a lot of copies of First Word Plus in stock so, "while stocks last", as they say, we are offering it at £75 (Acorn's full price is £92).

• **Genesis special deal** – We have ended up with rather a lot of copies of Genesis in stock so, "while stocks last", as they say, we are offering it at £75 (Software Solutions' full price is £100).

• **Herewith the Clues!** – A Dennis Wheatley murder mystery from Actual Screenshots. £23 through Archive.

• **Laser Direct is here!** – Computer Concepts' new laser printer mentioned in last month's Forthcoming Products is now available. Well, a small number have been shipped out of which I have just one for sale at £1080. We've tried it out and it does seem very much faster than the Apple LaserWriter NTII (PostScript) laser we use normally. The quality is, as far as we can see, identical (at about 1/3 of the price!). We hope to have some detailed comments on it next month in the DTP Column.

• **Ovation** – the professional DTP system from Beebug Ltd is now available. For £99 +VAT (£105 through Archive) you get wordprocessor and DTP rolled into one. It comes with four full outline fonts. We hope to get a review copy soon, so keep your eyes on the DTP Column.

• **Panasonic Sheet-Feeders & Ribbons** – We now sell cut-sheet feeders for KX-P1124 printers at £125. Also, ribbons for Panasonic KX-P1124 printers (which had been proving difficult to get hold of) are now also available at £11 each.

• **Pendown II** – Schools' wordprocessor from Longman Logotron is now available in a pre-release version of the Primary version for £39 + VAT (£42 through Archive) with a free upgrade to the full Primary version when it is released "in September". The secondary school version with spelling checker and other extra features is due in January 1991.

• **Poster from 4mation** is now available. It provides facilities for taking !Draw files and combining them together with text to produce "interesting" effects for displays, posters, etc. Images can be stretched, squashed and twisted. Poster comes either without any fonts for those who have already bought some outline fonts, or with a selection of about 20 fonts. The prices are £64 and £89 respectively plus VAT or £68 and £93 inclusive through Archive.

• **Presenter II / Graphbox / PipeDream 3 Hotlink**. There are now upgrades available for Presenter II and Graphbox which allow them to be dynamically linked to PipeDream 3. The idea is that, as you change the data in the Pipedream spreadsheet, the graph of the data is replotted automatically without further intervention from the user. Contact Lingenuity or Minerva for more details. (See also PipeLine Column on page 31.)

• **Shareware Outline Fonts** – Shareware discs 27, 28 and 29 are now available each with a batch of outline fonts. Each disc also has !FontEd and !Chars on it. Shareware 27 has 6 headline fonts, 8 script fonts, 12 serif fonts and 4 symbol fonts. (30 in total) Shareware 28 has 38 sans-serif fonts and Shareware 29 has 30 serif fonts. These fonts are **not hinted** and so will not be quite as effective at very small sizes on a dot-matrix printer though at larger sizes they are indistinguishable from more expensive commercially available fonts. Note that, to use them, you need Acorn's font manager which is available with Acorn DTP, Impression or Acorn's Font Starter packs.

• **Slideshow** – £14.95 inclusive from 628 Software turns your computer into an electronic projector by allowing you to display consecutively a number of

mode 12 or mode 15 full screen sprites with a range of different transitions.

• **Stig of the Dump** and **The Worst Witch** (educational programs) have now been upgraded to Archimedes versions. £19 and £22.50 +VAT respectively from Sherston Software. (£21.50 and £25 after 31/7/90) Both relate to English AT1 & 2 but Stig of the Dump is for 9-13 year olds and The Worst Witch for 7-10's.

• **!Store from LCI Software** (£4.99 + 75p p&p) is a utility which stores certain system variables which enable the computer to know how to run various files which you may have on your (hard) discs. It stores the RMA sprites which are used to give icons for the various filetypes from different applications which you may have.

• **Superior Golf** is well named! For £19.95 (£18 through Archive) you get six courses (3 at 18 holes plus 3 at 9 holes) plus a driving practice range and a course and hole editor. It has a lot more features than Holed Out including on-screen map and range indication as well as club selection with distances quoted (all of which are on paper with Holed Out). The driving is done with a power meter similar to Holed Out but then you have to catch it on the swing meter to avoid hooking or slicing the ball. The other immediately obvious difference is that putting is done with the same 3D view as driving whereas Holed out gives a bird's eye view of the green.

• **Watford ARM3's** available – We are now stocking the 30MHz Watford ARM3 upgrades. Although the supply is intermittent, we do have a couple in stock at the moment. For comparison with the Aleph equivalent, see the Comment Column on page 11. Also available are ARM3 upgrades from SPEM in Italy. More details later.

Review Software Received...

We have received review copies of the following: Geoscan world geography from Passkey Marketing, Armatron from Z&Z, StopPress from the Advisory Unit, Pendown, Herewith the Clues!, Escape from Exeria and Slide-show form 628 Software. A

Forthcoming Products

• **Acorn's new Unix machine**, the R200 series has been announced and was on show at the Unix Show. It has 4M minimum upgradable to 16M, the ram on the machine at the show was running at 12 MHz and the main processor, ARM3, at 30MHz. It comes with Ethernet as standard and a SCSI podule with 100M drive. There is space on the board for a floating point chip to be added. More details in Brian Cowan's article on page 17.

• **Minerva software not available after all** – We reported last month that Minerva said in their press release of May 17th that Easiword and Flexifile would be available at the end of May. Unfortunately, they now say that they cannot say exactly when they will be available. It will be "fairly soon" but "not in the immediate future" because they are working on an integrated office suite called Desktop Office which will contain Easiword, a spreadsheet, graphics facilities and communications. (Minerva are now at their new premises: Minerva House, Baring Crescent, Exeter EX1 1TL but the phone and fax numbers remain unchanged.)

• **New PC emulator** – It has not been announced yet (indeed, it may never see the light of day) but Acorn are working on a new PC emulator running MS-DOS 3.3 which will support EGA graphics. It will emulate 8087 (we think) and will have some sort of support for the FP podule. One major improvement over the current emulator is that it will run within a window on RISC-OS. (There is also a company working on a Mac emulator that will work within a RISC-OS window but we haven't been able to get any information about it yet.)

• **RISC-OS 3 ??????!!** – There seems to be some confusion over Acorn's intentions about enhancing and upgrading RISC-OS. The July issue of Acorn User gave details of a new 2M RISC-OS on 4Mbit ROM chips with enhanced versions of !Draw, !Edit and !Paint and multi-tasking versions of ADFS, RamFS and SCSI filing systems. Various other information was given, including a suggested upgrade price of £80-110 and the news that these chips would be fitted as standard on all new machines produced next year.

However, Acorn have issued a press release specifically about the Acorn User article, in order to 'clarify a number of issues relating to this article which may cause some confusion'. They affirm their commitment to RISC-OS and a program of research, development and enhancement of what they believe to be 'the most powerful operating system available on desktop microcomputers at the present time', but they deny any firm plans to release a new version in the near future. Their statement suggests that any such upgrade would only be released after a process of full consultation and trialling and certainly not during the course of 1990. (An anonymous donor has sent us a disc copy of an early version of the new RISC-OS3, so we know they have already developed a fair amount of it. Ed.) A

Contact Box

• **Anyone interested** in setting up an Archimedes User Group in the Storrington (W. Sussex) Area? Contact Mr R.L.Williams, Badger's Lodge, The Street, Thakenham, Nr Pulborough, West Sussex, RH20 3EP or telephone 07983–3855.

• **ArcBase** is a bulletin board based in Sweden. It uses Hugo Fiennes' ArcBBS software (as does Archive BBS). It is open 24 hours a day on Local 08-965195 or International +46 (8) 965195, 8n1 and V21, V22, or V22bis. For further details contact Hans Ringdahl, Malmvagen 45, S-19161 Sollentuna, Sweden.

• **Belgian Archimedes User Group** – Hobby Computer Club, Kleine Markt 7-9, B 2000 Antwerpen, Belgium.

• **Danish BBS** – Quercus, the Danish Acorn BBS have changed their phone number to 45 + 31 67 97 70. It runs on an A3000 using the same software as Archive BBS and will be joining FidoNet. It has approx 25 M of PD software (BBC + Archimedes). 24 hours 300/1200/2400 baud. Foreign callers most welcome! (From UK, dial 010–45–31– etc.)

• **German Archimedes BBS**'s – In Germany there is an Archimedes Network Group on MausNet. The following BBS's belong to MausNet:

MS	Munster	0251-80386
AC	*Achen	0241-154949
HB	Bremen	0421-86675
BN	*Bonn	0228-254020
M	Munchen	089-654708
SL	*Schleswig (my home box)	049603-1203
WU	*Wurzburg	0931-2013925
WN	*Winterbach / Stuttgart	07181-44195
S	Stuttgart	0711-354111
STA	Pocking / Starnberg	08157 – 7626
R	Regensburg	0941 – 999128
HH	*Hamburg	040-5381657
B	Berlin	030-3961067

The ones marked with a * are already connected to the Archimedes Group. The others can easily be connected. Just drop the SysOp a line saying that you would like to read it. My net address is 'Birger Harzentter @ SL'. Those who don't have a modem, but would like to get contact in Germany can write to me at Eichenstrabe 1, 2390 Flensburg, West Germany.

• **Midland Area Archimedes User Group** is starting. Anybody interested in exchanging ideas and programs should contact – Neil Berry, 21 Pargeter Street, Stourbridge, West Midlands DY8 1AU.

• **South Manchester / Stockport / Cheshire User Group.** Is there one? If not, is anyone interested in starting one? If so, contact David Adamiak, 27 Broad Oak Lane, East Didsbury M20 0QB. A

Credit where...

• I would like to thank Ken Thanas of **Microvitec** for his prompt action over a defective A3000 Cub Monitor. Not only did he offer to repair it free under Microvitec warranty but also phoned me immediately he received my letter of complaint and arranged for a carrier to pick it up the monitor from my house. I am looking forward to its return. Jesse Luxton

• To **Minerva**, who speedily and without any charge updated my two year old version of SigmaSheet. Stuart Bell

(Yes, the chap with whom Minerva got very cross when he tried to show people how to back-up their protected software!) A

Hints & Tips

• **Arthur Fonts** – when using the FontDes program supplied with Arthur operating system, it is possible to vary the thickness of one or both ends of the line. This is achieved by using the adjust button when the mouse is positioned over a line in a 'char full' window (this then highlights the line) and then pressing the menu button at either end of the line. This will bring up a 'pen ratio' window which allows you to alter the percentage ratio of the pen at that point, the ratio is set by clicking on the percentage window's quit box.

• **Extras Brushes for !Paint** – you can add your own brushes to the !Paint package by including the desired shapes in the 'Sprites' file i.e.

(i) Open up the !Paint directory by double clicking on !Paint while holding the shift button down

(ii) Load the 'Sprites' file into !Paint

(iii) Create the brush shapes you want in this file

(iv) Save the 'Sprites' file

Don't forget to make a note of the names of the brushes you created so that you can access them from the tools menu. David Parker

• **Hard Spaces** can be entered using the <alt> key and typing <1><6><0> on the numeric keypad but a much quicker way is just to type <alt><space>. Charles Moire

• **Lightning strikes** – Be warned! Don't leave your modem connected to the phone line when there is an electrical storm. I did and the spikes that came up the phone line killed a new V22bis modem and the RS423 port on the Archimedes! David Leckie

• **Memory Saving** – It is worth remembering that sprites with masks take up twice as much room as those without. If all sprites are altered with !Paint to remove the mask, a considerable amount of memory can be saved. Ian Hamilton

• **Printing with 1M** – when using Draw, Paint, Impression, Acorn DTP, etc you can quit !PrinterDM (or whatever printer driver you use) to reclaim about 80k of RAM. It would appear that these applications only need the modules that remain in the RMA area after the !PrinterDM application has been quit so all the print options are still available. R J Denison

• **Wimp Window Drawing** – The usual construction for defining a graphic window and drawing into it would look something like this:

```
DEFPROCgraphic_window
VDU26,5,24,graphicsbx%;graphicsby%;
          ;graphicstx%;graphicsty%
ORIGIN reportbx%-scrollx%,
                  reportty%-scrolly%
ENDPROC

DEFPROCdraw_text(x%,y%,text$)
MOVE x%,y% : PRINT text$
ENDPROC
```

This will work okay until the values in the origin statement exceed 32767. I found that I had blank screens in the middle of large reports. The following changes cured the problem:

```
DEFPROCgraphic_window
VDU26,5,24,graphicsbx%;graphicsby%;
          ;graphicstx%;graphicsty%
y%=reportty%-scrolly% :
                  compensationy%=0
REPEAT
IF y%>32000 THEN y%-=32000 :
            compensationy%+=32000
UNTIL y%<=32000
ORIGIN reportbx%-scrollx%,y%
ENDPROC

DEFPROCdraw_text(x%,y%,text$)
MOVE x%,y%+compensationy%: PRINT
                              text$
ENDPROC
```

Although you would have a problem in the x-direction, it is unlikely that a window would be that wide. A similar change could be applied if this was necessary. Ian Hamilton A

SILICON VISION News

ARCHIMEDES SOFTWARE DEVELOPMENTS, ISSUE 2

RISC OS SolidTOOLS achieve total integration

SolidTOOLS is the first fully integrated environment for 3D CAD, Photo-realistic rendering, Interactive animation, Programmable animation and high resolution hardcopy to printers and plotters for the Archimedes taking the computer to new heights of design productivity and performance exceeding the capabilities of 'heavy-weight' packages on PC-compatibles and workstations which cost considerably more.

The software provides 3D CAD facilities for Architectural, Engineering and Interior design and adopts the industry standard 1st & 3rd angle projection technique for drawing simultaneously in plan, front and side elevations together with a 3D projection to view the design from any angle. A unique smooth shading facility is also provided for instant high quality rendering of the design for improved presentation.

An interactive 3D animation facility also allows flight-paths for cameras and objects to be drawn to create 'fly-through' effects for animated sequences to further improve presentations or to analyse the ergonomics and aesthetic qualities of the design.

The system also boasts breath-taking photo-realistic capability using advanced ray-tracing techniques with object orientated design facilities pushing the Archimedes colour display hardware to its limits for reflections, transparencies, shadows, and textures.

Extensive hardcopy facilities are also provided to output designs to printers and all industry standard plotters at maximum resolution for high quality CAD drawings.

The powerful RISC OS multi-tasking capability also allows greater integration with other related applications such as DTP and ART software so that 3D shaded images may be included in other documents for improved presentation.

An 'open architecture' approach also allows the importing of externally generated designs and programming facilities allow access to the high performance 3D display functions of the package for further customisation if required.

Business Software

The new range of professional business software is now available and includes DataVision for true relational database management which is unique in providing both relational data-entry and reporting facilities together with integrated wordprocessing, mail-merging and label printing facilities. The Financial Accountant package for business accounting also includes DataVision and provides a fully integrated accounting system.

ShareHolder for share portfolio management & OfficeTOOLS for office automation and computer controlled presentations further extend the range to provide powerful serious business software for the demanding user.

All software run in native mode on A300-400 Series & A3000 with RISC OS and are available now.

SILICON VISION LTD, SIGNAL HOUSE, LYON ROAD, HARROW MIDDLESEX HA1 2AG. TEL: 081-422 2274 or 081-861 2173 FAX: 081-427 5169. TELEX: 918266 SIGNAL G.

PCB Design Tools

The recently launched ARC-PCB Professional package is the result of continuing research & development to produce a powerful PCB design system which out-performs 'heavy-weight' PC-based PCB layout design systems costing considerably more.

Features include Automatic routing, Rats-nesting, Multiple-layers, Circular, Oval & Surface mount Pads, 0.001" resolution, 32"x32" maximum board size, On-line Help, Fast Zoom/Pan/Redraw, Text & Silkscreen facility, Variable Track/Pad/Text/Grid sizes, Hierarchical Part Libraries, Block Move/Copy/Rotate/Mirror/Erase options, Component Pulling, Clear pad holes, Drilling data, up to 300,000 components and instant editing operations for substantially increased productivity. The industry standard HP-GL, GRAPHTEC, PLOTMATE plotters and printers at their highest resolutions are supported for high quality PCB artwork. An optional GerberPLOT driver supporting Photoplotters for the highest quality PCB artwork is also available.

SILICON Designs

Electronic design engineers and educational institutions are discovering that the Gate Array design system from Silicon Vision provides a cost effective introduction to the world of chip design where expensive silicon fabrication facilities are not needed but only the design facilities for teaching purposes are required at a low cost. This avoids the expensive trial and error iterations with industrial systems during the early stages of learning chip design skills.

Further Information

A free product catalogue detailing all our software packages for the Archimedes is available on request.

Help!!!

• **!ChkSpr** – Does anyone out there know how to work !ChkSpr on Shareware 19? Ray Dawson

• **Impression** – Can anyone suggest why I have trouble linking text frames across pages? It appears to work if I click on blank frames but not if I make a new frame on a different page, after having typed some text into the frame I want to link from. Ray Dawson

Help offered

• **A UIM Character Editor** has been written by David Sheperdson. For those who are interested, it has been included on this month's magazine disc.

• **ArcWriter fans** may be glad to hear that it can be made to work from the desktop and even in mode 20. If you want further details contact Lorcan Mongey, 56 Salisbury Court, Dublin Road, Belfast BT7 1DD.

• **Canada or USA** – If you need help getting an Archimedes working on the American sub-continent, Angus Mackenzie at University of Texas, 6431 Fannin Street, Houston (phone (0101) 713–792–5566) is offering to provide advice.

• **ViewSheet version B1.0** BBC ROM image can be made to work with the 6502 emulator by altering the image as shown below:

```
*LOAD view 9000
?&9560=&EA : ?&9561=&EA :
    ?&9562=&EA
*SAVE view  9000 + 3FFF
```

(For the faint hearted, a conversion program has been put on the monthly program disc.) D J Holden

• **Thanks** – Many thanks to all who responded to my 'Desk Jet Plus + Impression' request last month – all correspondents seemed maniacally enthusiastic! No more replies, please. Stuart Bell. A

Comment Column

• **Acom** (No, not 'Acorn', but 'Acom') – I picked up a copy of Acom, the new multi-tasking comms package, when I was over in Holland on holiday. While doing the usual tourist bit, I visited Delft and discovered ECD's shop. André van den Berg very kindly showed me Acom and gave me a copy for review. I would like someone to do a proper review of it, but from my initial playing around with it, it seems quite good value for money. It provides rawVDU, ANSI, Viewdata, VT52, VT100 and VT-220 terminals and has an extensive Viewdata editor. (It would be interesting to know how it compares with Stop Press, mentioned in last month's Products Available section, which is a Viewdata editor costing £30 + VAT and is also available for review.)

Acom has Telesoftware downloading (both UK and Dutch protocols) and ASCII and Xmodem file transfer. This is one obvious limitation in that most comms packages, such as Hearsay, also have 1k Xmodem, Ymodem, Sealink and (for what it's worth) Kermit. Still, it is fully multi-tasking and is less than half the price of Hearsay. Since it is multi-tasking, you can do things like using !Spark to un-compact a file you have just down-loaded so that you can check if the down-load has worked. Or you can use !Edit to modify a text file prior to up-loading it. Then to send the file, just drop it onto the Acom window. The danger, of course, is that because it is multi-tasking you could get engrossed in something and forget that you are still on-line and run up a huge phone bill!

Other aspects of its multi-tasking are that it works in any mode, it provides separate toolbox windows and it has extensive on-line help using Acorn's !Help facility. This is rather fortunate as Acom does not come with a manual! They may be producing one in due course (and providing other file protocols apparently) but for less than £30, you can hardly complain.

Other features include:

* 32 number, Hayes compatible, auto-dialling phone book
* Chat mode can be used to talk to, and send files to, other Acom users (via Econet, presumably).
* 8 savable 'profiles' in which you can specify speed, data format, terminal type, etc – these can be called by the phone book.
* spool a session by dropping the file into an open filer window.
* User definable keys

We hope to have them available from stock by the time you read this. Paul Beverley.

• **Archimedes Chess** – I have been waiting in hope of Colossus Chess to be released. I did purchase, last year, a copy of David Pilling's Wimp Chess and, although it played a nice game at good speed, it was rather clumsy to use.

David has updated it to the new version and what a difference – really desktop compatible with all the facilities you require. Of course, a board can be saved graphically (via !Paint) and used in DTP, etc.

This is now a first class product and worth far more that the few pounds he asks for it and I now find it hard to imagine what Colosssus Chess will be producing. John Crabtree

• **ARM3 upgrades – Aleph or Watford?** Now that the Watford ARM3 upgrade is becoming available, people are asking whether the Aleph One upgrade is worth the extra money (£650 instead of £460). The first comment I would make is that we have not found it too easy to get hold of the Watford upgrades. Aleph seem to be able to get hold of the ARM3 chips more easily.

If you put the two upgrade boards side by side, you will see several differences (apart from the price!). The most obvious thing is that the Watford board is upside down for simplicity of construction. This means that the ARM chip is **underneath** the p.c.b. which reduce the heat dissipation and also means that it is just above and quite close to the MEMC chip. Apart from again making the heat dissipation worse, this also means that other upgrades which use the MEMC chip socket will not be compatible as there is not enough space for the connector to fit underneath the p.c.b.

The other worry about having the p.c.b. upside down is that there is the possibility of the underside

of the p.c.b. (which is facing upwards) shorting out on the metalwork above. Watford have tried to prevent this with a single layer of insulating tape but the sharp cut off ends of the component leads very quickly puncture the tape.

Another difference is the 84-way connector which fits into the ARM chip socket. The one on the Watford board is not as well engineered as the one used by Aleph as it uses what looks like pieces of p.c.b. track as contacts rather than the metal pins used by Aleph.

There is also a marked difference in the amount of decoupling used on the two boards (i.e. capacitors on the power supply lines to avoid interference between different parts of the circuit.) Aleph may have over-done the amount of decoupling (22 capacitors compared to Watford's 5) but when the cache is operating, the ARM3 draws quite a current, so it is better to err on the side of using too much rather than too little decoupling. With a product that retails at several hundred pounds, it seems pointless to cut down on components that cost just a few pence.

Finally, the Aleph board is a 4-layer board which again may be thought to be over-engineering.

I hope this is not unduly negative towards the Watford board – it works well enough or we wouldn't be stocking them. Also, in their favour, they do provide an extractor tool for D.I.Y. fitting, and £190 (£650 – £460) is a lot of extra money for a few extra features which may not make a significant difference in practice. Paul Beverley

• **Impression** – After reading all the reviews, I finally succumbed and purchased Impression. So I thought that my first foray into this software might be enlightening to some others. I have never used DTP before but am quite conversant with Microsoft's Word Processor Word 5, which uses similar principles e.g. Styles, etc.

I copied the contents of all four discs onto my SCSI hard drive and double clicked with select on the Impression Icon. An error message 'No such file' appeared. That was the end of that day's session. A phone call next day to Computer Concepts (CC from now on) gave the answer, apparently there was a bug in the !Default document, that Impression searches for on startup. Basically a quick load and resave was the remedy. Whilst on the phone I mentioned that I was not happy with the way the 'Dongle' stuck out at the back.

That evening, I cured the !Default document and was immediately able to load in one of the sample files. Having loaded the RISC-OS Printer driver I tried to print the sample file. The result was rubbish, mainly Greek looking characters!

Next day a ribbon cable arrived by return of post – the 'dongle dangle'. I fitted this at the back of the computer, followed by the 'Dongle' and finally the printer cable. I tried a printout of the sample file again, this time the result was blank paper. I returned both the 'Dongle' & ribbon cable to CC and received replacements back, with apologies, once again by return post. This time success! Now I could at last start to see what it was all about. Whilst I expected some problems, this was certainly more than I had anticipated, however I have nothing but praise for CC with their telephone help and prompt actions!

The only other problem in use so far, came when I tried to print out using the Draft printing method. I have a Canon 1080 printer which has NLQ capabilities. The SAVELX module provided, has only the codes for Epson which differ from the Canon. With the help of CC again, I have changed the codes and renamed the driver module to Canon. This all works correctly and prints out in NLQ now, so I have suggested Paul puts it on the monthly program disc.

My main criticism is of the manual. I think that everything is probably there but where do you find it? The answer to queries I had about printer margins, due to the fact that the sample documents were clipped at the top, were found in the Hints & Tips section (Page 218) and in Section 2, page 90, a tutorial on Dialogue boxes (the box called 'Fit Lots On Page'), certainly not where I would have expected. I would like a Trouble Shooting section plus one on Error codes. However it's early days and I am enjoying learning to use this very well thought out software. Roger Power, Dunstable

• **PD software** – I have had one or two comments about PD software since my comment in the inside front cover of last month's magazine. I would like to make it clear that I was not referring to APDL of 96 Lanehouse Road, Thornaby, Cleveland TS17

8EA. We have an arrangement with them in that if they distribute any of our Shareware and Careware they give us something for our charity appeal for each disc they sell. They have just sent us a payment for discs they have sold and have donated every penny of the sale price to charity. They have not even kept anything to cover their expenses. Would that all PD suppliers had the same attitude!

One PD supplier, Sandy the Walrus PD, has suggested to us that we should be offering royalties to PD software writers. I don't know what other people think but I reckon that the whole point of PD software if to get as much reasonable software out to as many people as possible. So, if you add the complication of sending royalties, you add considerably to the admin burden of running such a library and obviously put up the prices of the discs.

The same PD house also challenged the "high price" we charge for our PD discs. Anyone who has had anything to do with running a full-time business (as opposed to running a PD library in your spare time) will know that by the time you take VAT off the £3 and then take off something for staff salaries, rent, rates etc etc, you don't have a lot left to pay for the cost of the media plus postage and packing.

The other factor which I mentioned last month was the amount of software on each disc. We try, wherever possible, to cram as much as we can onto each disc because the costs of distributing a disc with 800k of software on it are exactly the same as distributing one with 200k on it. Paul Beverley.

• **Postscript** – In the Archive 3.8 page 14, I commented on the incomplete review of printers in a previous publication. Unfortunately brevity encourages generalisation. Mr J. R. Thom of St Mellow, Cardiff, sent a letter detailing the availability of cheaper Postscript printer options, vis: Starscript from Laserine of Romford or the Pacificpage cartridge for an H.P. Laserjet. Mr Thom also asks why Archimedes Postscript files have line feeds but no carriage returns. This brief article attempts to explain what Postscript is and why files do not contain carriage returns.

The best way of learning about Postscript is to read the Postscript Language "Reference Manual" and the "Tutorial and Cookbook" both published by Addison-Wesley. On the other hand, with an Archimedes, it is possible to learn by experimentation or hacking as understood in its original sense. As an experiment, use !Edit to create a simple four line file. "Mary had a little lamb, etc" will do. Install !printerPS on the icon bar. Redirect its output to a file by changing the default nul:: to something useful, PSTEST, maybe. Drag your four line test file onto the printerPS icon and wait while the disk drive chugs away. Next drag the resultant PSTEST file with its pretty "F" icon onto Edit. Your four line test file has changed to 2 pages of text with the original four lines near the bottom looking like " (Mary had a little lamb) show". As a further experiment, use !Draw to make a box, say four inches square. Print it out. Now the PSTEST file contains even more text and at the bottom your file appears as...

```
x y M
x y L
x y L etc
```

You managed all that without even needing a printer. The two files you have looked at contained Postscript and if you have access to a Postscript printer it is possible to edit the PSTEST file changing some of the values and then print it out by dragging it onto the !printerPS icon.

Postscript is an interpreted, post fix (or reverse Polish) notation, stack orientated, page description programming language! It uses a model of a page to produce its output and is device independent. The code sent to a 300 dots per inch (DPI) laser printer will produce the same output on a 1200 DPI typesetter though at higher resolution. Commands are not separated by line feeds, carriage returns or semicolons but an end of command is identified. If you look at the Draw output you will see in the second page a lot of Postscript packed onto one line and that among other command definitions "lineto" has been been redefined as "L". The interpreted nature of the language explains why most Postscript printers use serial communications (which is bidirectional) as this enables the interpreter to send error messages back to the computer saying things like, "I didn't understand the last command and so I am not going to print any more". It is possible to interrogate the printer, showing the last value on the stack for instance, to debug software.

At a simple level, Postscript can be used as a plotter with movetos and linetos to draw a graph. The width of the line can be defined as can the sort of lines being used, dashed, dotted, etc. Text can be added after defining the size and shape of font to be used. That, however, is just the surface of the language which allows procedures, dictionaries, loops, conditional execution, arrays, curves, filled shapes, grey scales and so on.

The user does not generally see much Postscript as it is mostly used as a printer driver i.e. in between an application and the printer. Most of the mainstream PC packages e.g. MS Word or Excel have a PostScript printer driver. Where the Archimedes is different is that the driver comes free (on the extras disk or with a DTP package) and applications direct their output through it. Where programmers may have to program in Postscript is if they need to convert existing output and make use of the fonts in the printer. For instance, the output of a flat bed plotter may not be acceptable for publication as the lettering may not conform to the required style. Translating the plotting code to Postscript solves the problem of output and has the added advantage of producing code which can go directly to a typesetter.

When writing a plotting code to Postscript converter (essentially another interpreter) the postfix notation can cause problems. For instance when translating code which says take a pen and draw a thick dotted line from x1 y1 to x2 y2, the Postscript equivalent would look like "x1 y2 moveto x2 y2 lineto l1 linewidth p1 pentype stroke". All very well until you use multiple pen changes then when you encounter a pen change you have to specify the pen just finished with! Choosing a font is less of a problem as the plotting command "PRINTsize text" translates directly into "/Times-Roman findfont size scalefont setfont (text) show".

On a PC there will be other areas where programming in Postscript may be necessary since PC packages do not usually have access to outline fonts. However on the Archimides with !Draw, !Fonted, !FontFX and !Fontdraw you will seldom find the need. Bruce Edelsten

• **Standards in education** – In response to Martyn Wilson, having used both MS-DOS and RISC-OS extensively, I would endorse that from experience, RISC-OS is far better suited to education than MS-DOS. We expect children to learn perhaps a dozen different applications in a relatively short space of time and, without a consistent user interface, most of this time will be spent teaching how to load and save files rather than how to use the computer as a creative aid to the curriculum.

Further, the 'lack of software' argument is now a non-starter. There are just as many problems finding good educational software for MS-DOS machines in certain areas as there is finding RISC-OS applications in others. In most cases RISC-OS software is both less expensive and more appropriate for the classroom (though there are exceptions).

Take Genesis for example and compare it to Linkway, IBM's new hypermedia offering currently being given 2 full pages of the Times Educational Supplement in advertising. Both cost about the same, but what about the audio add ons required to give decent sound output on the PC? How do pupils edit music files to play from Linkway? How easy is it to edit graphics and import them to build a Linkway application? What about animated films in a window?

I let an eleven year old loose with Genesis and within a couple of hours she created a meaningful application allied to a project. Don't get me wrong, Linkway is a powerful application and in some ways more sophisticated than Genesis, but it is designed primarily as an information retrieval system whereas Genesis is an information creation tool. It is, in my opinion, more educationally valid to encourage children to be creative in their own right than to display other people's work.

The only real argument for MS-DOS in schools is "industry standard" but for how long, given the current interest in Unix? In any case, most people interact with applications and are totally oblivious to the operating system and there is no universal industry standard user interface which is really what counts. Ian Lynch

(By the way, would Martyn Wilson, who wrote the original article, please contact us as we can't remember which of the various M Wilson's on our database you really are?!! Oooops! Ed.) A

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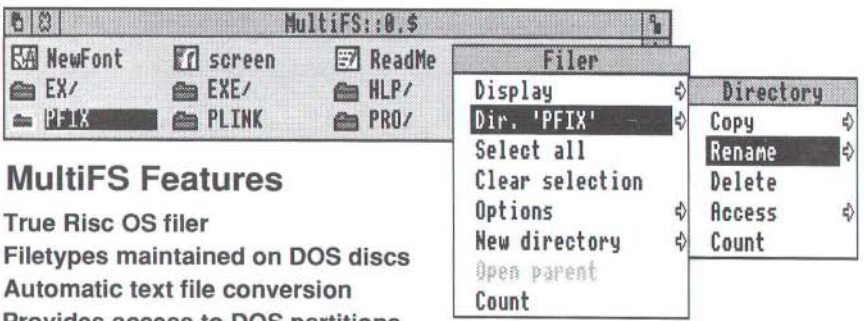

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Acorn's New ARM3 Machines

Brian Cowan

The new range of ARM3 microcomputers from Acorn Computers were finally unveiled to the general public at the European UNIX show in London's Olympia. Readers will rightly infer that these machines are intended primarily for the UNIX market although, as with the older R140, RISC-OS is provided in the system ROMs. App-arently, according to Acorn, this is the standard RISC-OS version 2, upgraded only to allow for the maximum RAM capacity of 16 Mbytes. Official policy is still that there will be no new version of RISC-OS released "this year". (See Forthcoming Products, page 4.)

Memory

The motherboard contains the standard four megabytes of RAM together with a MEMC1a memory controller. However, there are three RAM expansion slots provided. Each of these can accommodate an expansion board containing a further four megabytes together with its own MEMC1a. The maximum RAM capacity is thus 16 Mbytes although this full complement is not provided on any standard machine. These computers are referred to as the R200 series and there are two models: the R225 contains just the basic four megabytes while the model R260 has one RAM expansion board, giving eight megabytes.

Interestingly the latest publicity sheets state that the RAM in the old R140 machines is expandable to 8 Mbytes. This must indicate acceptance by Acorn that it is rather difficult running UNIX, particularly with X Windows, within four megabytes. It seems unlikely that Acorn will be providing memory expansion boards for the Archimedes 400/1 machines, so we must assume Acorn's seal of approval for some of the third party RAM expansion boards.

The CPU

There is no CPU on the main board! The ARM3 chip is mounted on a vertical board which plugs into the mother board next to the RAM slots. The reason for giving the CPU its own board is related to a future floating point coprocessor and maybe the ARM4 chip. Readers of the Hardware Column will know that the ARM3 chip has its own coprocessor bus since the external data bus is interrupted by the RAM cache. Acorn have sensibly dumped the WE32206 floating point chip which was used on the old floating point podules and they are designing their own floating point accelerator. This chip is expected to be available some time in 1991. It will sit next to the ARM3 on the CPU board; this is clearly a sensible approach. Of course once the floating point chips are in production it is but a small step to include this design on the CPU chip – this must be the ARM4!

This scheme is bad news, however, for those thinking about other coprocessors. On the old Archimedes series 400 machines using an ARM2, there is the coprocessor slot on the backplane. This can be used, apart from the WE32206 based floating point coprocessor, for such things as a video coprocessor or a digital signal (co)processor. This opportunity seems to have been lost on the new machines. At the least one would need a plug/socket connection to the CPU board, but this is not impossible. Or maybe the manufacturer of a coprocessor board could include the ARM chip on board so that their unit simply replaced the standard CPU board.

Two machines

The R225 computer has no disc drive: neither floppy nor Winchester. However all R200 models come with the Ethernet (and thin Ethernet) interface as standard so, essentially, this provides the filing system via a remote server. There is recognition that the old 50 Mbyte hard disc was a bit optimistic in that the R260 is provided with a 100 Mbyte drive and the standard 3.5 inch floppy disc drive. I am disappointed that it is only a standard floppy drive since there are many applications where one would like to read/write high capacity 1.4 Mbyte discs. Presumably, the machine is still using the 1772 disc controller chip; this should have been changed. The floppy disc question is my only serious complaint about the R200 series.

The internal 100 Mbyte hard disc uses the SCSI interface, so there is no need for ST506 support. An ST506 interface is provided as an option; I assume this is essentially the old hard disc podule, as provided for the Archimedes model 300 machines. In practice I can't see why anyone should require this, unless it is for compatibility with older machines and the portability of hard discs and their contents. A consequence of this is that on a standard machine ADFS is now only for the floppy drive, whereas the SCSI filing system must be used for the hard disc.

Video enhancements

There are some new video modes available. I believe these are as a consequence of a faster clocking of the video controller chip, a modification available for the older machines. As a result there is VGA having 256 colours as well as super VGA (800 x 600) with 16 colours. For the RISC-OS user these extra modes are not as important as the improved video hardware; we have the software to produce whatever modes we want.

Conclusion

What is my overall view? Firstly, remember that these are primarily UNIX machines and I know of no plans to sell an Archimedes-only version of the hardware. The fact that this is not an "exciting" new machine from Acorn is really because they got most of it right first time. Apart from the coprocessor bus problem there are no incompatibilities with earlier models. Also, thanks to some very good third party suppliers, all of the developments in the new machine can be fitted as upgrades to our old Archimedes computers (not the A3000). As yet, final prices for the machines have not been set. However, as Paul has pointed out, an old machine plus upgrades will probably cost less than the comparable new machine.

My main complaint is with the floppy disc capacity. Apart from this, the computer is a tribute to the brilliance of the design of the ARM chip set and the original Archimedes hardware scheme. A

Acorn's Press Release of 19/6/90

Acorn's own press release provided, amidst the usual PR blurb, some technical information which adds to what Brian has told us. The R225, discless machine, is priced at £3,000 (+VAT) but one thing which occurred to me was, if it is discless does it come with Unix? The answer from a direct contact with Acorn is that Unix is supplied on appropriate media so that it can be booted into the R225 from another machine on the network. The R260 machines will "start from £5000". Delivery was said to be 12 months but a hurried correction press release came three days later which changed it to 12 *weeks!* I hope this wasn't a Freudian slip!

Software

The R200's apparently come with RISC-iX 1.2, compliant with X/Open (XPG3) and compatible with System V and BSD environments. The "pre-installed" software includes "the enhanced X Window System based on the X11 Release 4 from MIT Consortium; the X.desktop 2.0 from IXI; OSF Motif 1.0 derived toolkit and *mwm*; PC emulation; and networking support including TCP/IP and Sun's NFS Version 4."

Acorn say that there will be lots of software support from third parties such as: UNIpiXel image processing from GEMS from Cambridge; UNIRAS and P-GKS 2D/3D graphics tools suitable for H.E.; FAM from FEGS finite element modelling and pre- and post-processing; Q-Office and Uniplex office automation suites; Informix 4GL database; Zelix accounting; Acuity management graphics; Delphi Common Lisp (DCL) from SIMIS; and 4GL appplications on Dataflex such as WIMS Estate management and Sculptor's Cross-Cast accounting software.

Speed

The ram speed and processor speed have apparently not been finalised but the machine on display at the Unix Show was apparently running with 12 MHz ram and a 30 MHz ARM3. The speed of the machines that will eventually be on sale is not yet finally decided. The increase in speed of the ram over the Archimedes (8 MHz) is, in some ways, more significant than the speed of the processor. If you reckon that the higher resolution screens need a bandwidth of, say, 7.5 MHz they will only just run on the Archimedes whereas the R200 will have several MHz to spare for processing rather than screen up-dating. A

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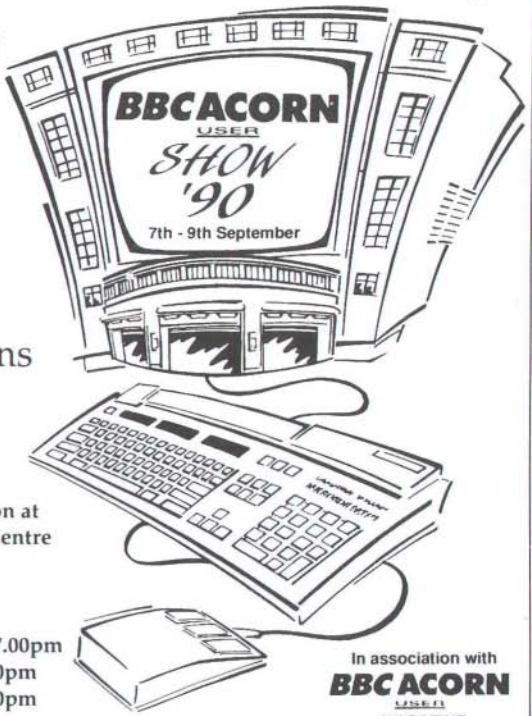

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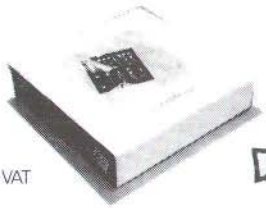

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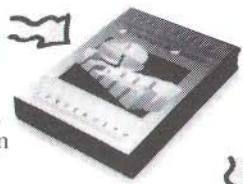

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Atomwide's VIDC Enhancer

John Ward

Atomwide's VIDC Enhancer is a very small board containing just a crystal and a couple of other components and with two flying leads.

When installed in an Archimedes A300 or A400-series machine it allows the Video Controller chip (VIDC) inside the Archimedes to be switched to a higher speed, which permits higher resolution screen modes, i.e. more dots per screen. I gather this is within the capabilities of the VIDC chip, which is not likely to blow up from running with its speed cranked up by some 50%.

High resolution screen modes take a lot of memory – typically between 250 and 320 kbytes for 16 colours – so it may be difficult to use on 1 Mbyte memory machines.

Of course, a multiscan-type monitor – such as the Eizo 9060SZ supplied by Norwich Computer Services – is necessary to gain the benefit of this device. A small toggle switch enables and disables the VIDC Enhancer, although software control is possible instead of the switch. This needs your Archimedes to go to a "component-level service centre" (Atomwide themselves are such a centre whereas N.C.S. are not) to make a small modification to the Archimedes' circuit board.

A floppy disk is supplied, containing a relocatable module "MegaModes" which provides 18 new modes and a ReadMe text file which tabulates the resolution and colour details of these new modes. This table is duplicated on the back of the four-page leaflet included with the enhancer. (There is also a public domain RISC-OS hypertext application with four "stacks" on the disk.)

Installation

Installation is very straightforward, necessitating removal of the Archimedes' cover by undoing the usual 5 screws – with the mains power disconnected of course! The little gadget seems a bit vulnerable, so it needs to be handled with care. Even so, one wire broke away from the board during installation in my workshop and had to be re-soldered.

A pair of links have to be removed from the machine's circuit board (but keep a note of which way round they went in case you ever wish to replace them) and the Enhancer pushes down over the four pins.

Unfortunately, if you fit the board round the way the leaflet says it should go in, some adjacent links (at least in A400/1 machines) get in the way, and the device does not fit very firmly. I have been unable to speak to the relevant person at Atomwide about this. *(I think John must have one of the very early 410/1 machines as those links are no longer fitted. The enhancers fit snuggly enough on all my computers. Ed.)*

One of the flying leads splits into a spade – which just stretches to its destination on the backplane (if one is fitted – otherwise you will need to use one of the connectors on the main board). The other part of this wire contains the connector for software control. If you are not having this option fitted, you can either cut off the connector or stick it onto the casing somewhere with masking tape.

Finally, the wire with the switch can be brought out somewhere – the best place would be on a backplate half-width panel. This you have to provide and drill out yourself. I think that, at the price, Atomwide really should have supplied a panel with the hole pre-drilled for the switch. In contrast to the too-short wire for the spade connector, the switch's wire is, if anything, over-generous and tends to end up coiled around inside the computer. This should do no harm if it is kept away from the hot RAM chips (and any hard disk) at the front of the machine.

The enhancer in use

It is essential to be able to disable the Enhancer, as many programs need specific screen modes (e.g. demos), and ordinary modes do not always display properly with the enhancer on.† Also, any sound (even the switch-on "bong") will be transposed up in pitch with it enabled. This is because the VIDC also provides the Archimedes' sound facilities, which are geared to the chip's normal running speed. At 1.5 times the normal speed, music and other sounds will be transposed up a 'perfect fifth' musical interval!

†*See Ian Entwistle comments overleaf.*

At last we are ready to try it out, so reassemble the machine, plug in and switch on.

For most users, only the 16-colour modes will be of interest as 2- and 4-colour desktops are unclear and unattractive, and 256-colour modes are not possible (because the Memory Controller (MEMC) cannot feed 256-colour screen information fast enough). I give details of these 16 colour modes below.

[Notice that although modes 110 and 114 seem to be identical as the number of pixels is identical, the scaling (in RISC-OS "logical units") differs by a factor of two. The result of this is that, in the desktop an application which uses logical units (such as PipeDream3) will display a different number of lines. PipeDream is a useful example as it gives line numbers in the borders, so I have included in the above table the maximum number of lines PipeDream3 will display in each mode without overlapping the icon bar.]

Mode	Pixels	Mem'y	PD3	Notes
98	800 x 600	240k	27	= "Super-VGA"
102	1152 x 486	240k	46	
106	1280 x 480	320k	50	Flickers
110	1024 x 640	320k	30	Flickers a lot
114	1024 x 640	320k	70	Flickers
118	768 x 576	224k	26	

My favourite is Mode 102, which gives lots of lovely pixels and does not flicker at all, and I have *CONFIGUREd WimpMode to this mode, which RISC-OS accepts. The BASIC Editor on the other hand accepts only modes which are in the RISC-OS ROMs.

The flicker can be tiring after a while and can even produce a headache, so the modes which suffer should be avoided except for very brief viewing. *(The flicker in modes 106 and 114 is hardly noticable on my systems. It may also depend on what other devices are near the computer. Mains transformers in adjacent equipment can cause flicker. Ed.)*

It is worth trying to standardise on just one or two modes for your regular activities as not only is it necessary to switch the VIDC Enhancer on or off between some of the standard modes and the new ones, but the display size and position sometimes need to be adjusted. This can become tedious on monitors with the relevant controls on the rear panel, but is just a momentary inconvenience on monitors like the Eizo 9060SZ which I use *(and the 9070 – see Products Available. Ed.)* which have these controls on the front.

Conclusions

Although the VIDC Enhancer seems to be an unfinished product which scarcely fits well enough to work, in practice it does do what it claims, with the qualifications of flicker and display adjustments mentioned above. If you have the necessary multi-frequency monitor and enough memory to spare for the screen, this not-too-expensive add-on will give screen displays not far short of those obtainable on graphics workstations like Sun, HP/Apollo, Intergraph and the like. Whether this will be useful depends on your needs and whether your software will take advantage of the enhanced display. Certainly all my true RISC-OS applications (!Draw, !Edit, !Paint, !TimeWatch, !PipeDream-3 plus various Public Domain desktop games and utilities) seem to work properly.

The main benefits show in applications such as Computer-Aided Design & Drafting (CAD) – for showing fine detail in complex drawings – and Desktop Publishing (DTP) where a whole page can be shown without having to scale down the view to the point where detail vanishes "between pixels". However, you will have to learn to cope with just 16 colours, which reduces the number of grey shades available for anti-aliasing fancy/outline fonts as well as limiting the range of hues for graphics applications. For many people this probably will be no great problem and you can always switch to mode 21 (for instance) to check colours. It seems strange to think that this action would reduce the resolution to a mere 640 x 512 pixels!

I am very pleased to have installed the upgrade but I hope that Atomwide will attend to the above points regarding wire lengths and fitting to the Archimedes links.

†*Ian Entwistle comments that he also has to switch the enhancer on and off, but I find it works OK in all modes even if the enhancer is switched on all the time. What do other people find? (Please specify exactly what system you have and give the*

computer's serial number if possible – there must be a reason for it.) He also comments that mode 106 is "just fantastic" whereas the 640 line modes flicker on his 9060. He also comments that if anyone needs convincing that you can only really get the best out of the Archimedes by using a multi-sync then they should see the enhancer in action. Seriously, if you have spent £500 plus on a multisync then you would be crazy not to invest the extra £35 for a VIDC enhancer. However, I would say don't all rush to buy the 9060's because Eizo UK are having problems importing enough to satisfy demand and although we have five in stock at the moment (June 23rd) Eizo won't be getting any more from Japan until the middle of July. The newer 16" 9070's are less of a problem to get hold of.

My only other comment is that if you get used to the advantages of the higher resolution modes, you will find yourself wanting the extra processing speed that the ARM3 provides – and that's another £460 if you can get a Watford one or £650 for one from Aleph One! A

Small Ad's

• **A310 + RISC-OS**, 4 slot backplane, manuals & software : 40,000 Bfr. Acorn MIDI podule + manual + books "Music through MIDI" & "MIDI for musicians": 5,000 Bfr. Contact Koen Lefever (Belgium) on 02/251.67.09

• **A420/1 £1100** ono (including free software), Fujitsu Multisync monitor £200 ono, Citizen Swift 24 pin printer with colour kit £250 ono, Scanlight Junior £125 ono, Amstrad SM2400 modem £150 ono. Contact Mr G Templeman on 0553–767611 ext 231 daytime, 0553–675182 evenings.

• **Acorn Hard Disc Podule with cables** £85, Acorn MEMC 1a upgrade £35, Atomwide 4 slot backplane with fan £20, Acorn ROM podule £10. Telephone Mr C P O Pennington on 0925–827391.

• **Arc Software**: Acorn DTP £90; Sigma Sheet £25; Gammaplot £25; First Word Plus (version 1) £20. Phone Mr Edmundson on 0727–59450.

• **Archimedes Software**: 11 games, plus Jigsaw, PC Emulator, Artisan and Education. Most half price, all originals. Contact Mr Kidd on 091–416–6407.

• **Autosketch V 2.0 & Realtime Solids Modeller** £50 each. Phone 0246–270730 after 6 p.m.

• **External 67Mb hard disc** ST506 type. Little used. Swap for SCSI or sell. Cased with p.s.u. £450. Glenn Baugh, 48 Squires Pridge Rd, Shepperton, Middx, TW17 0LB.

• **For Sale: 1st Word Plus** £43 ono and Digisim (Musbury Consultants) £28 ono. Contact Mr M Roscoe on 081–579–0607.

• **For Sale: Graphic Writer** £15, Alpha-Base £20, DeltaBase £15. All in good condition. Contact Mr R Ahmad on 051–722 5799.

• **Holed Out** £9, Graphic Writer £13, Corruption £9, Pacmania £9, UIM £14, Clares Sound & Graphics Demo disc £3.50 + many more 'cheapies'. Phone J Park on 0672–810545.

• **Logistix** £95, First Word Plus £45, GammaPlot £30, SigmaSheet £30, Pixel Perfect (version 2) £50. All prices ono. Contact Dr B Smith on 0493–662966 ext 136 daytime only.

• **Programs in original packaging** UIM, Terramex. Star Trader, Minotaur, Quazer, Clare's Arcade at only £8 each or £35 the lot. Telephone John 0803–33755 afternoons or Sundays.

• **System Delta Plus v2** £40; First Word Plus £40; EMR Sound Synth with Creations Disc 1 £30; or the lot for £100. Telephone Mr Belringer on 0793–696402 (daytime), 0392–51219 (weekends).

• **Watford Video Digitiser** £100, CC ROM/RAM podule + 4 x 32k chips + battery backup £30. Ring Mark on 0244–535204.

Charity Sales

• The following items have been given for sale in aid of charity. Please ring before sending money to check availability. CJE Micros' BBC serial link & software £8; CJE Micros' BBC serial link & software £10, Artisan & Artisan Support £12; Akhter 1M A3000 upgrade £60; Topologika Giant Killer £5; SigmaSheet £20; Greydumps £6; First Word Plus £30. A

First Word Plus Column

Stuart Bell

Importing ASCII files

Barry Watts raised the first query this month – the problem of importing ASCII files into FWP which then cannot be re-formatted to the current ruler without doing each line individually. The relevant back issue of Archive is 1.10, when an analysis of the problem (it's all to do with CR's, LF's, and Hard Spaces) is presented and conversion programs are listed. Those programs (and the ones on Archive's FWP-orientated Shareware 6 disc) pre-date RISC-OS, but a more recent solution is to be found in !1stFile. This is a public domain application which installs on the icon bar and supports the following conversions: 1wp to Text, 1wp to View (text), Text to 1wp, View to 1wp, and WordWise+ to 1wp. I got my copy from STWPD on 'PD Disc 1' but the application is available separately as 'UTL02A'. Perhaps I should but I really can't interest myself in the esoteric 'innards' of various word-processors, when ready-worked solutions are available at little more than the cost of a blank disc. I sent Barry a copy of !1stFile – after all, it is Public Domain – and it seems to have solved his problem. If you want a copy, send me a formatted blank disc and return postage in a small jiffy bag – !1st file is public domain software. FWP2 is NOT multi-tasking!

"My printer has stopped!"

There I was, printing out a file and editing another, when the printer suddenly stopped. At that instant I was in the page layout window setting up the parameters for a new layout and FWP would not continue the printing until I hit the 'OK' or 'Cancel' buttons. It would seem that FWP doesn't 'top-up' the RISC-OS printer buffer whilst it is waiting for such responses. It's hardly a major bug but don't leave FWP in such a state when you go for lunch expecting to return to find that 60 page report nicely printed!

LQ problems, continued

Dennis Croome has an on-going problem with graphics output under FWP2 on his LQ-550 printer. However, he can get decent output with !Paint and the RISC-OS driver. So, it appears that it must be a FWP driver problem. Has any reader got good graphics output with a similar system, please? If so, do write to me so that I can put you in contact with Dennis.

Graphics problems – on a Star

John Pennington had a problem much like that of Christine Shields with his Star LC24-10 printer, noting that with fanfold paper the graphics output was okay but with friction feed it wasn't! Apparently, for friction feed: vertical tab and vertical reverse tab are turned off. His work-around is to load a single sheet, set the printer up for friction feed and then move the sprocket feed lever forward, without fanfold paper being loaded. This makes the vertical tabs work and prints graphics that use them. I hope that this solves Christine's problem.

Pausing problems

S R Anthony rang the Archive office with the question, "Can you get a daisy wheel printer to stop between pages when printing in First Word Plus?" The answer (as so often) is 'it depends'. It doesn't depend on the printer that you're using – I pause between pages (especially with envelopes) with my daisy wheel printer without problems. How it's done (and whether it works) does depend on which version of FWP you use. With FWP1, you have to set the sixth parameter in HEX file for your particular printer to '1' in order to make the printing stop after each page. (See page 220 of the FWP1 manual for details.) However, early versions of FWP1 did not stop, even if this parameter was set! Brian Carroll wrote about it in Archive 1.12, page 11, and Mike Hobart elaborated in issue 2.5, page 18. Acorn replaced such defective copies free of charge. Since this bug was recognised in 1988 all more recently-purchased copies should be OK.

In FWP2, Acorn very sensibly moved this option into the printing dialogue window so that it can now be set for a particular document and doesn't have to be fixed for all time. Since this flag is so obvious in FWP2, I suspect that Mr Anthony must have FWP1 and will have to amend his printer configuration file. Ian Nicholls' article in Archive 2.2 remains the authoritative tutorial on this topic.

Risc User FWP Index

Since I finished the index of all FWP-related items in Archive (see last month's column) I've now done the same for Risc User. I've asked Paul to put it on this month's program disc (it runs to just twelve entries). Despite its relative brevity compiling it did remind me of a couple of useful articles in Archive which I'd forgotten, so the modified Archive index is also provided on the monthly disc.

Columnist's doormat suffers concussion

My offer of FWP printer drivers for the KXP-1081 clearly met a need – it also led to me being inundated with requests! Please help me if you are requesting anything on disc by using a proper Jiffy bag (ordinary envelopes don't give enough protection) and also by enclosing a ready-addressed label for its return. Some folk send the disc in a SAE bag, inside another envelope, which works just as well.

To finish, the usual reminder that I'm at 56 Crescent Drive North, Woodingdean, Brighton BN2 6SN (no phone calls, please), and would be glad to receive hints, problems, wishes, cries for help and requests for indices or !1stFile. A

Bug Hunter + Moon Dash

Ian Griffiths

These two games, for the price of one, from Minerva, are supplied as Bug Hunter with Moon Dash thrown in free. Both games are written in BASIC and compiled using Dabs Press's Archimedes BASIC Compiler (ABC) which seems to be madness when writing games which, to my mind, should be smooth, fast and furious. Sadly this seems to be the prevailing attitude when the available power rises – applications which older machines were struggling to cope with are easy work for fast machines like the Archimedes, so writers seem to feel compelled to add some handicap to bring the code back down to its old level. In this case, Ian Richardson seems to have shot himself in the foot by using compiled BASIC and – as far as I can tell – System Sprites. (Moon Dash certainly uses system sprites – the sprite file is visible on the disk – but for Bug Hunter, everything is in compressed format files. This is ostensibly the same as Atelier but it crashed when I tried to look at them.) System Sprites are convenient for amateur games writers and more importantly for hardware independent software (under Desktop) but I believe that professional games should use dedicated routines and thus get the most out of the machine. Moon Dash runs in MODE 15 and succeeds in being considerably slower than the BBC version of the game!

Bug Hunter

In this game you play a failed genetic engineering experiment called 'Hysteron Proteron', originally designed as an eight foot killing machine, but ultimately produced as a dubiously drawn six inch biped with a large mouth "and an irrational dislike for insects..." which of course leads not very neatly into the plot of the game. So as to justify your existence as a life form (a dangerous ethical point perhaps) you have to work as an insect exterminator for a pest removal company (not mentioned in the instructions, but simply implied in the graphics) by paying house calls and dropping things on insects. Judging by the apparent mentality of the insects, most of which simply wander back and forth in a fixed space, I suspect that a human with a pair of 'Doc Marten's would be far more efficient at the job – although a tin of CFC free insect spray would be required for the bees which are intelligent enough to follow you around.

However, cynicism aside and putting up with the somewhat disappointing lack of polish in the graphical presentation, we must look to the game play. You have sticky feet and can thus walk along any surface no matter what the incline. You may pick up single objects and drop them (some fall, some break or are used up when they land and cannot be re-used and some rise to kill beings which have learnt to walk on the ceiling). You may jump provided you are not holding an object, which is logical as there are only three controls – left, right and a context sensitive pick up/drop/jump. These keys are available as ZX<Shift> and also on the mouse buttons for no good reason. The game can be momentarily confusing when walking on the ceiling since controls become reversed, but is better than the irritating sort of game where you have to hit Up and Down keys at precisely timed moments.

Insects must be killed by letting go of objects above or below them and hoping they get hit, in which case they die. If you foul things up – for instance by dropping a non-recycleable object and missing – you can kill yourself which resets the current screen. If you lose all three lives, you can restart at your current address – addresses are like passwords in most games – and in this case are meant to represent the house you last called at. You do not however get a refund of points: your score is set to zero when starting from an address.

The game falls loosely into the category of logical puzzle arcade games in so far as you have to work out what to shift where, but has neither the challenge or gameplay of – for example – the Repton series on the BBC and Archimedes. Some 'puzzles' are to be solved more by chance discovery of features exhibited by various objects than applying great logic to the situation. Although the game is initially quite fun to play and some of the brief animations displayed when completing a level are amusing, I suspect that its lifetime will be somewhat limited.

Moon Dash

The plot of the second game on the disk is almost completely dispensable, except in that it explains the little animation at the start of each game. In short you were transporting an armed road vehicle when some alien shot you down, blowing up your transporter but not your cargo of a hi-tech combat vehicle which you miraculously know how to operate. You need to drive back to base across a variety of scenes to tell your race that everyone is doomed. The upshot of this is that you are driving across a road with potholes (no explanation for these – just blue bits in the road which weaken your armour) with all manner of aliens trying to shoot you down.

The game is almost identical to one I had on my BBC, only while this one is more colourful it is much slower, jerkier and less exciting (although easier to play) and the controls are slightly different. The gameplay involves driving along a scrolling background, shooting anything which is trying to eliminate you. You have control of the gun turret's angle which can swing from directly forward to directly backward, allowing you to shoot from rocks and little trucks that launch missiles that I'm sure originated from Yie-Ar-Kung-Fu. Also through flying aliens and fireballs trying to get you, to the squat dalek shaped things, bouncy balls and robots that attack you from behind. The truck's movement controls consist of firstly a jump – allowing you to dodge potholes, small rocks and the wrecks left by fireballs which are not shot and secondly an accelerate – which has the effect of moving you forward across the scrolling background speed until you reach halfway across. At this point you cease to accelerate, and then letting go of this key lets the truck trundle back to the far left of the screen as is normal in this variety of game.

Again, the game has a password system for each level, but this time you are given a score bonus for starting at a high level. It might have been more sensible not to award this bonus until after the level has been completed since if someone publishes a password list – as is invariably done – this provides an easy way of getting a high score. However, it's nice to be rewarded if you have earned the score.

I prefer playing this game to its partner since there is more action – which increases as one progresses through the game. I'm not sure how much further it goes because I'm on level 10 after a couple of nights and it's getting a bit crowded. I'm finding things tricky since the gun doesn't really move fast enough to shoot enough things to avoid being killed (mouse control to allow faster control might have been a sensible option). Furthermore, looking at the sprite file for the game – which is on disk for all to see – it looks like I've not got all that many new sprites to encounter.

Conclusion

While these games are occasionally entertaining and playable, they are not going to achieve classic status or even grab anyone's attention for very long. Their mediocrity is a shame – if they had been written largely in assembly language (thus producing smooth animation and far more impressive visual impact) then they might be more tempting. Of course, gameplay is still the most important feature of any game and I suspect with these two, their playability will wear off all too rapidly. Editing the sprite files may prove more entertaining than actually playing the game after a while. So dedicated games players or anyone wishing to collect every game available on the Archimedes may want to obtain these games but they are nothing special and at £17.95 (£17 through Archive) seem a little pricey for the majority of users. A

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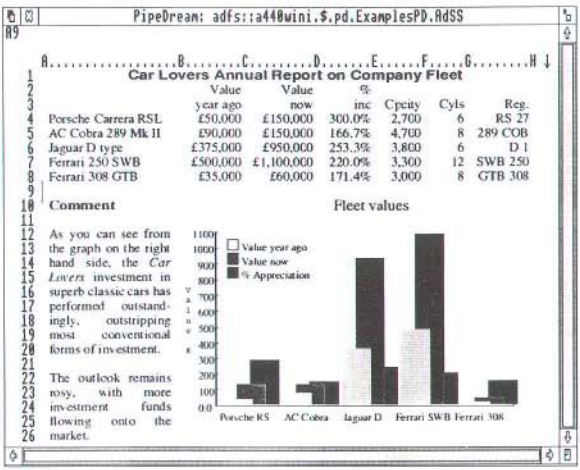

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All trademarks acknowledged. The chart in the screen shown above was produced by sending numbers from PipeDream 3 to Lingenuity's Presenter 2 and then loading the resulting graph back into PipeDream 3.

Colton Software, Broadway House, 149-151 St. Neots Road, Hardwick, Cambridge, CB3 7QJ, England.

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PipeLine

Gerald Fitton

Too many people confuse 'Easy to learn' with 'Easy to use'. Reviewers, who are working to publication deadlines have to "Learn" the major features of a product quickly and their comments (and criticisms) all too often reflect how easy or hard it is to learn just these basics. Some pieces of software, often those with too few commands and too little flexibility to be of anything but passing interest, get an 'Easy to learn' label. What is more important in the long term is what you can do with it when you know how to use it.

Although it is possible to produce a simple 'word processed' document fairly quickly in PipeDream, you may be disappointed with the results of your early efforts. PipeDream is not in the "Easy to Learn but Hard to Use" category; if it were then there would be no need for a PipeLine column. 'Easy to use' is what you hope the software will be when you have learnt the best way of doing things – things which might be impossible with simpler applications. Learning anything which is not 'Easy to learn' is hard work, it takes time and lots of practice.

People who give up PipeDream generally do so (like those with aspirations of becoming a concert pianist) in the first week. Whilst in part PipeLine is intended to help absolute beginners, it is also intended to stimulate those who have made it past the 'Easy to learn' hurdle and want to share their knowledge, improve their techniques and do things which are impossible with packages that are 'Easy to learn'.

Free upgrade to PipeDream version 3.11

If you have registered your purchase of PipeDream 3 with Colton, you should have received a letter from them asking you to return your disc for a free upgrade to version 3.11. If you haven't, Colton suggest that you send your master disc, lightly sellotaped to a folded piece of card (e.g. a folded postcard), to them together with a self addressed 9" by 4" envelope with a 20p stamp on it. Robert Macmillan (of Colton) tells me that many people use too much sellotape and damage is done removing the disc from the sellotape. The self addressed, stamped envelope takes most of the hassle out of the administration of sending out thousands of upgrades and will encourage Colton's next (make it "Easier to Use") upgrade a free one too (5000 envelopes take over a hundred hours to address and £1000 to add 20p stamps).

Features of V 3.11

It is difficult to know where to start. Certainly not with PipeDream 2. If any of you still have PipeDream 2 (or no PipeDream at all!) then send me a self addressed sticky label together with a stamp and I will send you Colton's PipeDream 3 demonstration disc. The demonstrator has all the features of PipeDream 3 (about version 3.05 I think) including RISC-OS multi-tasking. With it, you can create or load in PipeDream files, sort, change the layout, etc but you cannot save or print with it nor does the demonstrator include the 93,000 word dictionary or spell checking feature.

I will start by assuming you have read the PipeDream 3 handbook (!) and go on from there. Firstly, I will deal with corrections and updates to the PD3 handbook and leave the most exciting new features until the end!

Loading multi-file documents

The description on page 211 of the handbook is incorrect. Dragging the list file's icon to the Pipedream icon loads the list file and opens a window showing the first file on the list. To edit the list file itself, you must drag its icon into an open Pipedream window.

Macro files

The sample macro file on page 325 of the handbook is incorrect. For example, to define Ctrl-Shift F1 so that it generates the font command for Homerton you need: \CDF^i "Ctrl-Shift F1" ^i "@@Homerton.Bold,10@@" ^m. Note the double @ signs – to get a literal @ (one which shows instead of one which is hidden) you need one more @ than the command requires. It is the way in which the function keys are defined which is different from the handbook; no longer can you use ZF for Ctrl-Shift. I think that the best way of creating macros –

even the special 'Key' macro (called as PipeDream installs itself on the icon bar) – is with the macro recorder facility (Ctrl+FY).

Three quickies

Click on 'Files – Save' and you will not be prompted for a name (unless the current name is ambiguous). For myself, I prefer to use Ctrl+FS Return or a redefined Ctrl+Shift+F12 but many of you like to use the mouse. You can print the slot grid lines (useful for spreadsheets) and you can change the Caret & Border Colours from the 'Files – Colours' dialogue box.

Highlights & slot references in headers and footers

You can introduce highlights such as 'switch on italics' and you can copy the value of a slot reference into headers and footers.

Define command

You can define any Ctrl+character as a shortened command. For example, old Wordwise users may want to use Ctrl+A as a forward delete instead of using Shift+Delete (easier to relearn?). However, beware of using B C E F L P or S since these are already used by PipeDream and so redefining any of these will affect a lot of commands.

Font displayed on the screen

When you have chosen your 'Print – Printer font' then it is that font which appears on screen during editing. A partial exception is the line which you are currently editing. It too appears in the 'Printer font' but with any extra commands such as @F:Homerton.Bold,10@ shown in full. If your printer font is say Trinity.Medium but the line which you are editing includes the Homerton.Bold font command then you will see the line in Trinity whilst you are editing it and it will change to Homerton when you move the cursor to a new line. Some of you will find that it is easier to use the System Font as your 'Printer Font', because of its clarity, and then change it to say Trinity just before printing. If you do, then remember to reformat each paragraph before you print.

Overlaying drawfile graphics

Pictures can be included in PipeDream documents. Choose your slot and type in @G:<filename>,<scale%>@ where <filename> is the name of the file and <scale%> is the scale (as a percentage of the original Drawfile) at which you want it to appear in PipeDream. Another way of entering a graphic, which I find "Easier to Use" than typing in its name, is to position the caret in the slot (click on the slot with the mouse) and then drag the graphic from the directory viewer into the PipeDream window.

If the graphic file is not in the same directory as the PipeDream file then the full path name of the graphic file appears in the slot. If the PipeDream file and the graphic file are in the same directory, only the last part of the filename appears in the slot. Keeping the graphic and PipeDream file in the same directory is highly desirable if you want to send the file to somebody else (like I do) because their directory structure may not be the same as yours. You will find that dragging a graphic from a directory always loads at a scale of 100% (but you can edit it).

If the picture slot is in the line you are editing then you will see the graphics command with its @ signs and scale% factor so you can edit it in the usual way. However, if your cursor is in any other line, you will see the graphic displayed on screen. If you have a large graphic, say a border or frame around your whole page, then you can type anything into any slot other than the slot containing the graphic command. This includes the facility to enter other graphics within the first, larger graphic so that this makes PipeDream 3 even more like a desk top publisher than it was before (hard to learn but it makes possible effects impossible with some other software packages).

The 'Easy to use', simple example of graphics overlays consists of three !Draw files and some PipeDream text. The words "is not . . . being" entered as PipeDream text have to be in an area of the graphic which has the colour 'None' selected from the !Draw 'Fill colour' menu (or be in a transparent part of a !Paint sprite). I have used a line spacing of 13 point because this preserves the "What You See Is What You Get" nature of the overlays.

I have found problems printing sprites from other than square pixel modes (such as mode 1): I advise those of you who want to do this regularly to get a monitor which supports mode 20 (I can't afford it at the moment!).

Print scaling

A new option in the print dialog box (RISC-OS drivers only) lets you choose to reduce or enlarge your whole document. Scaling works from the top left corner of your document in both Portrait and Landscape orientations. For example, if your document is a wide spreadsheet then you can see it on screen at double the scale at which you ultimately print it. I recently created an A4 letter heading for a charitable organisation using PipeDream. They also wanted the identical heading scaled down to A5. I replicated the block containing the heading so I got two A4 headings side by side (one off screen to the right) and then printed out in Landscape at 67% size. Lo! and Behold! Two A5 letter headings needing only a guillotine to separate them. This is another 'Easy to use' feature which is not provided by, say, !Draw. Print scaling can get you out of some otherwise impossible difficulties but, to get the best results, you need practice.

Hot links

I am really excited by this feature of V 3.11 even if it is going to take me some time to learn how to get the best out of it. Load a spreadsheet into PipeDream and install a linked graphics application (such as Presenter II or GraphBox) which will convert your numbers into a bar chart or a graph etc. Now link the graphics application with PipeDream (by clicking the mouse on an 'Easy to use' dialogue box or menu). Then, when you change a number in the spreadsheet, the bar chart is redrawn to reflect the new value. The linked graphics application has automatically imported the new value from PipeDream.

If you link back from the graphics application to a graphic (of the bar chart) inserted into PipeDream, the bar chart in PipeDream will be updated as you change values in the spreadsheet. Multiple incarnations of the linked graphics application and dependent documents (which do sums on your spreadsheet in background) make HotLinks an exciting 'Easy to use' but 'Hard to learn' facility. I have prerelease copies of some graphics applications which can use HotLinks so watch this space! My only worry is that I may have to buy an ARM3 upgrade to get fast real-time changes with some of my more extensive statistical data sets.

Obscure & intermittent problems

Many, but not all, of the obscure and intermittent problems which you have written to me about are cured in version 3.11. If you have not yet upgraded then please upgrade to 3.11 and try again. If you have problems after installing 3.11 then write to me and I'll see what can be done.

Anagrams

I have received the definitive work on anagrams of words in the Colton dictionary from Paul M Skirrow. He has sent me (on disc) a suite of three BASIC programs which Colton have confirmed find all anagrams of any word in their dictionary! These BASIC programs are available in the usual way (see below). Using this BASIC suite he has proved that there are no words with more than eight anagrams in the PipeDream dictionary and that 'pears' is the only eight letter anagram! He gives five words with seven anagrams (crate, beast, alerts, slate and petals), fifteen words with six and 52 words with five anagrams! I have passed his definitive work to Colton (who are sending him a bottle of champagne) but you too can check out his BASIC suite if you like. He quotes a time as low as 40 seconds for one of the BASIC programs so the 'job' doesn't take all night!

Linking files for home accounts

I have received the following application of linking files from Stephen Gaynor. Disc files (with fictitious entries) are available. Of course, what can be done with Linking Files in PipeDream 2 can also be done with Dependent Documents in Pipedream 3 (but see Stephen's second paragraph for why he didn't use this approach). If one of you succeeds with such a conversion, I will include it in a future PipeLine article.

"When I had a Beeb I used Interbase to hold monthly transactions and then posted summaries to Intersheet for my account summary. I had one file on Intersheet for the year, but 12 files on Interbase, a set of transactions for each month (actually it was 13 as I get paid 4 weekly, 13 times a year). The approach I used with Pipedream therefore started from an attempt to keep to this approach.

"There is therefore one summary file (called 'Balances' on the disc). Then there is one file of

transactions for each month. These are created as required (just April and May on the sample disc). I considered using external references but that would have meant having 13 worksheets on the screen at once. I doubted I could handle that never mind the memory usage. So instead I used the linking file approach. This has the advantage that it is updated permanently by changes to the transaction files. Loading the summary file and recalculating draws the latest values off the link file. I only need the transaction file I am working on loaded. [I would still prefer to use dependent documents – after all you don't have to look at them. GF]

"The problem with linking files was that the normal slot reference could not be used. Column A had to be referenced as 1, column B as 2, etc. At first sight this seemed to mean that relative values could not be used. This would mean that entries could not be replicated and every entry would have be input slot by slot – a lot of work on the balance file for say 238 slots (17 rows by 14 columns). It would also be very inflexible as changes (say increasing the number of rows) would be a major task.

"However as you will see I found a way round this and the whole system seems to work quite neatly. Basically the idea is to set up a row containing the x values for the linking file (row 32 on the 'Balances' file) and a column containing the y values (col Q on the 'Balances' file). These can then be referenced and evaluated in the main body of the file: for example slot C5. Slot C5 can then be replicated to fill the block C5 O21, where each slot will reference the appropriate link file address. I'm not sure I have explained this very well but I think it is easier to follow from the actual file on the disc.

The transaction files follow the same principle. With the transaction file I have collected the totals for an account type into a block at the start of the file. This is not strictly necessary, but I think it's tidier. Finally, I have set protection so that I can only update slots that are meant to be amended manually. Also, recalculation should be set to manual for the transaction files. Otherwise the linking file is updated as each transaction is entered which is extremely irritating." [I have had another letter from Stephen saying that he has discovered that the Row and Col commands are "Easier to Use". GF]

PipeLine DTP – Fonts

I had hoped to include much more on this subject this month but space is short so I am limiting myself to a quick comment on EFF's RISC-OS fonts. The Electronic Font Foundry supply a range of over 100 fonts. I recently bought from them the four font set of Oxford (an Optima near look alike – but not quite) and the single font Tamsin (which looks like joined up writing).

There has been some criticism in various publications of EFF's fonts – I believe that much of this criticism is unjustified. Here's why: as the smallest size I normally use is 10 point (with occasional 8 point italic) with a 300 dpi laser printer, I tested out the fonts by scaling up to 36 point (i.e. 9 point times four) and printed out at the lower resolution of 75 dpi (four times smaller). I believe that this lets me see exactly what will be printed at 300 dpi using a size of 9 point without buying a microscope. I compared the results with Acorn's Trinity and Homerton using 75 dpi/36point and I could find no difference in quality between Acorn and EFF fonts – the only differences were due to the necessary (and desirable) differences between the font styles.

I have also used !FontFX with both Acorn and EFF fonts to create Drawfiles from characters in the fonts: these Drawfile characters can be rotated, scaled, turned into outlines only, distorted, shadowed and shaded, etc in the same way as other Drawfile objects. I have then returned the Drawfile 'characters' to PipeDream as pictures (this works even better now that graphics can be overlaid one on top of the other giving letters within letters!).

My version of !FontFX scales Acorn and EFF fonts similarly so I can mix them with impunity; about half a dozen readers have written to me saying that !FontDraw (available with Impression) doubles the size of EFF characters (compared with Acorn). My copy of the EFF book which came with the fonts says "...certain programs... do not scale our fonts properly. If you contact the manufacturers [of !FontDraw for example], they should be able to provide you with a correct version of their program."

One word of warning, I quote from EFF's book, "These fonts are not PostScript compatible" so, if you need PostScript compatibility in order to print

your masterpiece on a Lintronic at thousands of dots per inch, then EFF's fonts are not for you.

The Date

Try @D@ \Q^m \Z^m \BSS^m instead of last month's erroneous combination!

Disc copies of PipeLine files

All this month's disc files are available from Norwich Computer Services by buying their monthly disc. Alternatively, you can write to me at the Abacus Training address (see inside back cover) sending me a stamp and a disc (formatted please) in a jiffy bag asking for the files you want. I will copy them to your disc and return it in your jiffy bag.

Quarterly PipeLine disc

Many readers have written to me asking if I have a compendium of "Hints & Tips" or an "Advanced User Guide" for PipeDream. I know that some of you would be satisfied if I sent you a disc copy of all the PipeLine articles and the files of examples that go with them, but others who have written to me, and these include PipeDream users who do not take Archive, want something either different, more detailed, simpler or more advanced. What I am going to do is to produce a PipeLine disc four times a year. This is a 'magazine on a disc' which I hope includes something of interest to both beginners and experts. The first disc (available at the end of July from Abacus Training for £5.00) relies heavily on the subjects you have encouraged me to include in the Archive PipeLine articles augmented by advice I have received from Colton. Errors in the PipeLine articles have been corrected, I have got rid of all items of transitory interest and solutions which have been bettered, other topics have been put in a more systematic order (easy to hard) rather than in the chronological order they have appeared in Archive. The disc includes more 'worked examples' than was possible on a disc shared with other Archive users.

Contributions

Finally, thanks again to all who have sent me contributions for the PipeLine column. If you have an extended example (or a problem that needs a lot of explanation) then please let me have it on disc so that there are no errors of interpretation and so that I can more easily make it available to others. A

Arcade Soccer

Andrew Bloomfield

Assuming that you haven't already had more than enough of football just recently, here are a few comments about Dabs Press' Arcade Soccer...

Being a keen footballer, I was looking forward to Arcade Soccer and wasn't disappointed when I received it. It came in the usual CD type box (with an inlay card for the BBC B which I thought was a bit odd) but attached to the single 3.5" disc was a poster for the Archimedes complete with every conceivable instruction from keys/icons to curling the ball and how to enter the 3 selectable competitions.

Pressing the usual <shift/break> the program began to load (it doesn't load from the desktop). Immediately an 'action shot' title page appeared and, after the first part of the program had loaded, a version of the theme tune for the popular football programme Saint and Greavsie was played. By clicking on the mouse, the main part of the program loads and you are confronted by a whole range of fairly self-explanatory icons although you need the instructions by you all the same. You can decide various things such as whether you require wind, the type of weather, speed of players, kick power and other details which make the game all the more professional and exciting.

The next category is for playing normal friendly matches – it gives you choices such as team formation and goalkeeping skill.

Finally, after you have selected the various options from the menu page, you can make a choice from three different game settings:

The World Cup takes you to the World Cup Tables and from there you can enter teams of your choice which will be highlighted on the table. As in the real World Cup, there are six groups of four teams, each team with its own national coloured strip. After each game the tables will change according to your and other teams' results, which allows you to work out tactically who you have to beat to get into the

next round. Each of the computer teams have their own individual skills and tactics: some teams are spectacular and rather courageous whilst others repeatedly tackle and foul, creating horrific and ugly sound effects. When it's raining, thundering or chaotic (called that because it literally shows what players are made of), the task of beating the computer is all the more difficult – players go spinning and sliding everywhere.

The 1-24 challenge cup enters you to a 'knock-out' competition. You have to beat as many teams as possible, each one becoming more tactical and skillful as you progress.

Thirdly, a 'friendly' option is provided – useful when learning the package. Two players can battle it out between them, or one versus the computer. You can gain practice at long range shooting, curling the ball towards the far goal-post, various combination build-ups from corners and plenty of other spectacular set-pieces.

Over all, Arcade Soccer has good, clear graphics and sound. Is it worth £18? For the fun my friends and I have had out of it, yes. A

Music Column

Stewart Watson

The latest update to Studio 24 has just been released as version 2.0E. It contains several improved features and includes a new beginner's guide called 'Startbook' which is supplied as an !Edit file on the Utility disk.

An undocumented feature is the use of the up and down cursor keys to alter the tempo of a piece while it is playing. This can be very useful when you are experimenting to find the right tempo for a piece.

Although the program doesn't appear to have a cut facility, you can use the clipboard and the copy facilities to effect a cut. Let's say you have recorded a 40 bar piece but want to cut off the first four bars. Set the start locator to 5.1.0. and the end locator to 41.1.0., copy the section to the clipboard, open the copy window and select replace track. If you look at the track end locator you should see 37.1.0. This facility can also be used to cut sections out of the middle of a track and to copy sections out of multiple tracks.

New or changed features in version 2.0E:

Looping

Looping has an extra method of operation. Here are the two ways of using looping:

1. Looping from start to end of a track. This works as in previous versions. From the main screen, set the Track End locator to mark the exact end (e.g. 5:1:0 means finish at the end of bar 4). Set the number of repeats you wish to make in the Loop box. During playback, this track will play the whole track from 1:1:0 to the Track End locator for the number of repeats + 1. It will ignore the Track Offset in this case. This is quick and easy to use – it should always be used in preference to method 2 below unless Loop NME's are present in the track.

Unlike previous versions, you cannot use this method if you don't want looping from the start (1:1:0 in the pattern) to the end of the track.

2. Multiple looping around defined start and end loop points anywhere in the track using NME's in the Event Edit page. Music before and after the loop point(s) will also be played.

The looping must not be "nested" otherwise it could repeat indefinitely. This simply means that between one loop's start and end NME's, no other loops' NME's must be defined.

The Track Offset locator is used to set any offset required before the first Midi event on the track takes place. Before changing it, note the current setting in case you want to include this in your new value. For example, the Track Offset shows 1:1:4, so for a sensible start for placing the music later in the track, set the Track Offset Bar value followed by <return> twice. This will automatically set the beat/tick to the same settings as before e.g. 20:1:4 starts the music 20 bars later.

This looping method only takes place if there is at least one set of loop NME's on a track (a set means a Loop Start followed later by a Loop End event). These are inserted in the Event Edit page. Select this page, then click on Text to highlight it and click on it again until Loop Start appears. Now locate the event for its start and then click on Insert to put it in

the list. Alternatively, click on Insert with Loop Start highlighted and set the correct location for it in the list.

Click on Loop Start in the left column again and it will change to Loop End (and highlight it). Now click on Insert to put this NME in the track event list in the same way, making sure it is set to a sensible point in the music – either at the end or somewhere before. Remember, it is to be placed at e.g. 20:1:0 if you want the loop to go up to the end of the 19th bar (in the usual way for looping or track end). Another way of considering this is that no music for the loop should be on the event which has Loop End also.

Now select the number 1 after Loop Start in the event list and set it to the number of repeat loops required (from 1 to 127). Note that this loop number is used instead of the main screen loop value which is ignored whilst NME loops are present.

During play, the track will now play the required music, with defined loops and music in between and following, to the track end.

Track merge

A new function is provided in the Utils window: Merge Tracks. This lets you select up to 23 tracks in a pattern and merge them together on to another blank track.

When a number of tracks are merged, the following information is retained: the track transpose setting is merged into the pitch data of each note; the Midi channel Out setting of each track is retained (even if it is F, allowing multiple channel events on a single track) along with the mixer velocity (see below).

Track NME's (Non-Midi Events) are acted upon so breakpoints, loop points and fixed bar quantise settings are filtered out, but text marks and fingering remain.

In order to have a What You Hear Is What You Get situation, the merge function changes each note's velocity to incorporate any Dynamics NME's inserted in the tracks. The merged setup will no longer contain Dynamic NME's as a result but the music will sound identical!

To do track merge, first select the track boxes required to be merged with <menu>, turning them blue. Then select the track to be merged to with <select> (it is highlighted with a yellow surround). Select the Utils window, Merge Tracks and OK. After a brief delay, the tracks will be merged. You may now delete the original tracks if you wish.

This provides a useful way of combining tracks for output on the same channel – perhaps a string section – and regaining some more tracks for other instruments. It also allows a track to be permanently transposed to its Transpose setting for printout, etc.

Score music display

In earlier versions, a single bar that could not fit into the screen display window halted the display of music. This is now corrected by automatically selecting a higher quantise value until the bar's music fits. This is a compromise that occurs on the infrequent occasions that highly populated bars appear. Printout uses the same condition.

Interpreting realtime music input often introduces some complex arrangement of notes that have not been identified – for instance, occasionally a long bar line would appear. Previously, this could be edited out by simply changing the length of the last note in the bar. This is no longer necessary. If you do see an unpredicted interpretation in the music display, try editing one or more of the notes and change it to a clearer notation. Currently, acciacaturas and appoggiaturas are not re-interpreted but are seen as played.

Lyrics

When writing lyrics in a text editor (e.g.!Edit) a new Bar line marker is required: you should use <return> instead of "|". Original files with the latter should still work but you should use <return> in future.

Track offset locator

The operation of this is changed. Previously, this allowed you to set a fixed offset from the start of the track, independent of the track data. To allow the score music display and all edit pages to see the offset, the Track Offset now indicates the actual start of the first Midi event in the track, which is stored with the track data. This does mean that old music using Track Offset will have to be loaded, the offset re-entered and the file saved.

Track Offset works in the same way as before, except the position of the locator shows the actual start of the first event in the track.

Midi thru

Midi Thru now works in play operations as well as record and main screen non-operational time (if selected from Master Keyboard).

Realtime track changing

Version 2.0E allows a new track box to be selected to allow you to jump from one track to the other – most useful for examining music on each track in the Score window without stopping the music. (You have to go to VU meters window display first to make the change and then toggle Graphic to get back to score).

Graphic and drum edit

You can now play from the current bar to check your music without returning to the main screen. Both these edit pages enter without cycle activated. You should select the cycle icon in the left end of the control desk before selecting the start box. If you toggle cycle off, you can then select start to play from the current bar until you click on stop or press <space>.

The solo button will operate in Play and Cycle Play. During play, the bars will be scrolled beat by beat through the music. If you hear or see an new place for editing, stop the music, note the current position in the blue locators and use the fast forward/rewind beat-locators to find the new edit point (or enter its bar/beat/tick in the left locator).

Score page – new features

Several new features have been added to the score edit page:

'Play' with 'Solo'

If you select the play box to highlight it (next to the dustbin) you can play the music from the current bar (in the Bar box). Press <space> or click on play again to stop. Select "S" (solo) next to play before using it to flip between hearing the displayed track only or hear all the tracks currently set on/mute. This lets you check your music editing without returning to the score page. After play, the music always returns to the current bar.

Note playing and identification

Whenever you select a note for editing, it will be sounded on the current track's Midi channel briefly and a vertical red line will appear to show the current edit position. Be careful not to drag the note or the red line will be removed (unless you want to drag a note into the dustbin).

New music ruler

When you select a note, its exact position in the bar is shown by a small black arrow along a grid of time divisions suitable for the time signature selected.

You can drag the arrow to a new note start position (the Start box is updated as you do this) by clicking on it with the left button and dragging – the arrow snaps to the time divisions as you move it. Click on Update or Insert to move the note.

Updating a note

Always select the note first, then select the note box combination required in the bottom row (e.g. crotchet, dotted, triplet). This **must** be done even if it looks correct.

When you make the selection, the Length box will change (e.g. to 24 for crotchet).

This can be useful, for example, to reduce a crotchet's 24 ticks to 23 in order to make a clearer attack between notes (it will still be displayed as a crotchet in most quantise settings).

The other note parameters can also be changed whilst the note on the music has a red line: pitch, position in Start box or Music Ruler, or velocity.

Triplets

The Music Ruler makes triplet note editing much easier. The music display itself is changed to identify exactly positioned notes also of correct length (2, 4, 8, 16, 32 ticks) as triplets automatically.

In practice, if your music only contains a few triplets, you could selected a quantise operation suitable for the whole track, then use the Music Ruler to change the triplets to display correctly. If you use a global quantise afterwards, the triplets will obviously be lost!

Change a note to a triplet by selecting it, then highlighting the triplet box as well as the note type: crotchet, quaver, etc. The Music Ruler will now change its divisions to suit triplets and the time signature in use. Drag the Music Ruler arrow to the required triplet (e.g. the 5th division from the left means the 2nd triplet in the 2nd group in a 4/4 bar). Click on Update to make the change.

It may be necessary to alter the notes before or after the triplet group to make it happen – sometimes you also need to tidy up note lengths short enough to fit if they are the same pitch.

Inserting notes

Select a note in the bar to insert – or select a new location for the Start box. Select the note boxes at the bottom to choose the right note length, then adjust the Music Ruler arrow to find its position (if not exact in the Start box). Click on Insert and it will highlight briefly and insert the note in the music. Make sure the pitch is not the same as another note at the bar location or you won't be able to insert it.

Chord playing

Any time you want to hear a chord, select a note in the chord position (the red line appears) and hold down <select> on the Chord box. The chord will sound until you release the button. This helps greatly with identifying wrong notes in the chord.

Breakpoint

You can now set a BreakPoint (as an NME) for individual bars as well as the global BreakPoint normally visible in its box. This is often necessary for displaying piano music similar to the printed sheet it came from.

Select the required bar by clicking on a note as if editing – or enter the bar in the Start box. Now change the BreakPoint value until it is correct. Click on the word BreakPoint to activate the NME.

Quantise

You can now set a separate Quantise in Score Page for individual bars (as NME's) as well as the global value visible in the Quantise box (in Score Page and Track Window). Select the bar (as with BreakPoint above) and a new value of quantise, then click on the word Bar in the Quantise box to activate the NME.

Both BreakPoints and Quantise are placed in the beginning of the bar. When you scroll through the bars, you will see any BreakPoints and Quantise NMR's set for individual bars in their respective boxes (as well as their effect on-screen!).

The quantise process has been speeded up dramatically – it is now a linear function that quantises a piece previously taking a minute or more in just a second or so.

Textual marks and fingering

It is now possible to add text (and any mark using ASCII characters) to any position on the music display (and printout) as NME's. By adding a special prefix, you can add fingering to notes for teaching purposes (useful for MicroStudio files).

The text message can be up to 6 characters long. Select the space to the right of the word Mark and type in your text, followed by <return>. Place the text by first selecting a note in the bar to locate the horizontal position in the music (or set the Start box locator). Next, select the word Mark (a blue arrow appears) and move the conductor's baton to the vertical position required on the music display. Click the left button to place it.

Fingering can be done in the same way but requires a prefix F followed by a single number (otherwise it is regarded as text). For example, to insert 4 beside a note as a fingering guide, enter text: F4 then <return>. Place it as text above.

New dynamics table

Many instruments respond over their velocity range in a different way in terms of dynamics. One keyboard's "mezzo forte" (mf) may not be as loud or soft as another. This table lets you experiment with the best settings for your keyboard set-up.

Select the Options window from the top and select Dynamic Table. This opens a small box with the default settings normally used in the program every time it sees a dynamic mark on a track (inserted in Score Page). Adjust the values for each dynamic from ppp to fff if you wish. These can be typed in or adjusted up or down over the range 1 to 200.

A maximum value of 800 can be inserted, but there is little difference from 200 to 800. The range of 1 to 800 is also used in the mixing desk (and track options box). The upper values from 200 are used to enable very quiet sounds (i.e. note velocity levels) to be pulled up sufficiently.

Time signatures

When a time signature in compound time was selected in a pattern, the previous versions played these slower on the basis that the "type of beat denominator" was used in the clock speed equation i.e. 3/8 played half the speed of 3/4, 3/16 played half the speed of 3/8. This has now been changed on the

basis that a beat should be played in beats per minute, so 3/8 will now play quavers at the same bpm as 3/4 playing crotchets and so on.

NME's

All NME's can be removed from the Event Edit page. These are Dynamics, Loop Start, Loop End, BreakPoint, Mark and Text. A

Using the PC Emulator – Part 3

Richard Forster

This month we will look at the files on the boot disc in more detail. If you load up the emulator and do a catalogue of the original boot disc (not the one we have created) you should see a list of around 46 files, with various other miscellaneous information – from the name of the directory to the amount of space left on the disc.

There are far too many entries on the disc to fit on one screen and the top ones scroll past. Fortunately there is a way of getting around this and that is to add the parameter /W to the directory command. Type:

```
DIR /W
```

If you now look at the screen you have the directory nicely placed into five columns. This allows directories with a few hundred entries to be view at once. Actually this is the opposite of how the Archimedes does it. If, in ADFS, you type in *. you receive a directory of just the file names. You need to type in *EX to get a fuller listing.

In fact, there is there is a way in which we can view all the files with all their information without letting the data scroll past us. This is to add the parameter /P at the end of the command. Doing this will display the directory one page at a time.

While I am on the subject of the directory listing, I will describe DIR's last ability. This must be one of its most pleasant features – never let anybody tell you DOS is not user-friendly. It may occur that you only want to see those entries which are .TXT files or even only those files which have a filename of PROGGY. To do the first you would type in:

```
DIR .TXT
```

and to do the second

```
DIR PROGGY
```

Before we continue, a word of warning. Do not delete any files from this disc however useless they may seem. The one time you really need a file is directly after it has been wiped. Joking aside, it is best to keep the original boot disc for purely backup purposes and you never know when a piece of software will require a file on the disc for reconfiguration.

The LABEL command

The first file I want to look at is LABEL.EXE. It is not exactly a file which you will find invaluable but it is handy and has a very easy syntax, enough to reinforce various ideas already given. Its function is to give a disc a name – rather like the Archimedes' *NAMEDISC.

You have already encountered it, although you probably do not realise this. If you examine the top of the catalogue of the original boot disc you will see the line "Volume in drive A is ACORN-PC". The format of the command is simply:

```
LABEL [drive:] [label]
```

In other words, the command is called LABEL and it has two optional prefixes: a drive name (if the drive to be labelled is not the present one) and the actual label (up to 11 characters). An interesting attribute of the utility is that failure to put a label name in the command will give you a prompt. If you just press return, you receive the option to delete the label.

A couple of examples of usage:

```
LABEL A: GAMES1
```

This will call the disc in drive A, Games1

```
LABEL C:
```

This will ask you what to call drive C.

```
LABEL MYPROGGIES
```

This will call the current disc Myproggies.

The TREE command

Remaining with directories, we have the command TREE.EXE. As explained earlier, files are stored in a tree structure. Starting from the root directory (\) we can have other directories placed in it and further

directories in these directories. While this makes for a neater system, it is possible to lose files in it, especially when there is deep nesting (i.e. a lot of directories in other directories in yet more directories, etc...)

TREE.EXE has two uses. It will tell you where all the directories are in relation to each other and optionally list the files in each directory. Again it has a reasonably simple structure and, while not earth shattering, is occasionally useful.

```
TREE [drive:] [path] [/f]
```

The use of a path in the command allows you to get data starting from deeper directories. Thus if your root directory has twenty other directories and you only want to search from within the directory TEXT, you would add a path of \text. If you add /f to the command you will also get a listing of the files.

The two programs we have looked at so far are not particularly useful but you may want them on your working boot disc. There are some major utilities on the disc and I would like to finish this month with one of them...

CONFIG.SYS

This is not strictly a utility since you cannot call it up when the machine is running, but if it is on your boot disc, it is loaded when the machine is reset. It can alter things such as the number of files the machine can have open at any time or whether or not you have a ramdisc. We shall generate it using our way of creating a text file, placing any commands on separate lines and finishing it off with a <CTRL>+<Z> (or by pressing <F6>).

For details on all the available commands, try page 24 of the April issue. For now, I am going to talk about three of the available commands. BUFFERS sets up the number of areas in memory which DOS uses to store data when using discs. The effect of increasing this gives speed, though values about 30 give little increase and take up considerable amounts of memory.

The version of DOS supplied by Acorn (3.21) always sets the buffer value to 2 by default. Later versions are more 'intelligent' and set it depending on the amount of memory available to the system – setting it to 10 for over 256k and 15 for over 512k.

To change the setting you include a line in CONFIG.SYS saying:

```
BUFFERS = <amount>
```

I have this set to 20, which is also the value I set FILES to. This tells DOS how many files it can have open at any one time and this defaults to 8. The biggest difference this immediately gives is that directory listings seem to be speeded up, especially when using several directories. Some programs need more than 20 (which is an acceptable level) and you may find the need to alter the value to 30 occasionally. The syntax for the command is the same as that for buffers.

The DEVICE command

Finally we have the command DEVICE which is probably the most useful command available to config.sys. This accesses a device driver (a file with an extension of .SYS) which tells DOS how to use a particular device. This can range from a mouse (unfortunately Acorn do not supply such a driver) to setting up a ramdisc and displaying ANSI graphics.

The syntax of the command is DEVICE = [drive:] pathname.

ANSI graphics are a similar idea to teletext graphics (though better). They enable manipulation of colour with text and various symbols. Many PC programs use ANSI graphics for drawing pretty borders or placing text at desired places on the screen. As such it is a very useful file to have operational but it does have some drawbacks. It slows the machine down.

There is a very easy way of knowing if a program that you are using requires ANSI.SYS to be loaded. If you see groups of seemingly meaningless characters e.g. ←[37;7m←[0m←[26;01H then you know it does. These seemingly meaningless codes actually tell the computer where to move the cursor to or what colour to use for the text. When we examine BATCH files, I will show you an easy way of toggling between having ANSI.SYS and the limited graphics ability, to not having ANSI.SYS but having the speed.

The other useful device you can set up is a ramdisc. If you include the line:

```
DEVICE = RAMDRIVE.SYS
```

in your config.sys file, then when the machine is rebooted you will be greeted by a message informing you that a ramdrive is set up. By changing to the drive specified (e.g. D:) you will see it is effectively a new drive – albeit a far faster one. It is very useful for copying purposes, as you can copy files into the ramdisc and then out of it, without as many disc swaps!

A few words of warning about using CONFIG.SYS. Firstly it must be placed in the root directory. Any files it accesses with the command device should ideally be here as well because you can then ignore a fiddly path. Secondly, remember that any changes to the file do not take effect until the machine is rebooted. This is similar to the command *CONFIGURE, which only takes effect after a rebooting with <ctrl-break>.

Next month we shall continue to look at the files on the boot disc. A

Apocalypse

Alan Highet

Apocalypse is a 'shoot everything in sight' game by Gordon Keys. Those of you who have played Holed out or E-type will recognise Gordon's style of graphics and humour.

The story goes that the computers have become so advanced that they no longer need humans and so are wiping out all carbon-based life-forms in their colonisation of other planets. You have been given the task of single-handedly wiping out the Rakonans, as they are called. For this you have been given a very powerful ship called a Llanerk. Unfortunately it doesn't seem to be finished and is only equipped with basic armament.

To control the ship, you can use a mouse or a joystick in conjunction with the keyboard. The screen display is the 'Elite' type with the bottom third showing you all the instrumentation and the top two thirds displaying the solid 3D graphics.

To start with, you can only land on two of the eight planets but as you progress, you will be given the chance to move on. After selecting a planet, a map appears allowing you to choose whereabouts you land on the planet's surface. On the map are marked most of the Rakonans along with the buildings and airfields. Unfortunately, these appear as small coloured dots so it is quite difficult to pinpoint the type of dot you want which could be quite important.

On selecting a site, you are teleported down to the surface from the mother ship where the fun begins. Basically, your craft can skim along just above the ground or rise up to allow you to fire down on buildings or at the myriad of flying saucers that constantly chase you. You can also fly backwards but your craft is automatically taken up to avoid hitting low buildings. Then it's a question of blasting everything you can see. Gradually you will find that some things are worth a lot more than others and sometimes a message will appear telling you what you have destroyed. This is important because all of items must be destroyed before the planet is clear.

You carry on in this manner until you run out of energy or you are forced to leave because of damage to your ship. On arrival back at the mother ship you are assessed by three members of the 'Royal Guild of Spacings'. If you've been successful, you are given another chance on the planet and hopefully an upgrade to your ship but if not the game finishes. This is where Gordon's sense of humour comes in as the messages are varied and normally quite amusing although it doesn't take long to see all the messages. The Guild of three are interesting looking people – one of them bears a striking resemblance to Mr Spock and who keeps waggling his ears all the time.

I have to confess that although I have been playing the game regularly, I haven't yet managed to clear a whole planet and I think what would help me would be some indication how much more I had left to do. Having said that, I have got myself in the high score table so I'm happy.

Overall, I think this game will be yet another success for Gordon Keys and the Fourth Dimension. The graphics are good and flicker-free and the game is full of wonderful, colourful explosions accompanied by good sound effects and digitised speech. A

Introduction to C – Part 8

Chris Dollin

Thanks for the Memory

In this article, I am going to talk about the use of the standard C functions malloc and free to perform dynamic store allocation and de-allocation.

Grabbing store

Conventional programming languages operate by making modifications to pieces of store – variables, elements of arrays, fields of structures. Often what is required is a fresh piece of store which is used to represent some object or other. For example, when appending two strings, space for the resulting string is required. Sometimes it is possible to allocate this store statistically (i.e in an external or static variable). Sometimes it is possible to allocate this store dynamically, while a procedure executes, by declaring a local variable. However, this is not a general solution.

Consider, for example, the following function to append two strings and deliver the resulting string (the equivalent of BASIC's a$ + *b$*).

```
#include <string.h>
char *append( char *one, char
     *tother )
    {
    char result[256];
    strcpy( result, one );
    strcat( result, tother );
    return result;
    }
```

strcpy will copy the characters of its second argument into its first argument and *strcat* will concatenate the characters of its second argument onto the end of its first. Hence, *result* will contain all the characters of the first string followed by all the characters of the second. Then *result* (rather, a pointer to its first element) is returned.

Unfortunately, this will go horribly wrong. When *append* returns, all its working store – which includes *result* – is reclaimed. (Typically this is done by allocating it on a stack and cutting the stack back on function exit.) The pointer still points but the place it points to has gone away and will be re-used by the program. At best, you will get gibberish appearing in the string – if you are so bold as to write into it anything could happen (the store may have been re-used for return addresses or saved registers). If you are lucky, the program will crash mysteriously.

One way round this problem is to use *structs*. A structure value is not automatically converted to a pointer and a C implementation is obliged to pass structures as parameters, return them as results and allow them to be assigned with the expected results. We could exploit this thus:

```
typedef struct { char string[256];
                               } String;
String append( char *one, char
                               *tother )
  {
  String result;
  strcpy( result.string, one );
  strcat( result.string, tother );
  return result;
  }
```

(More consistent would be a version that takes *String* parameters, rather than *char* * parameters.) However, *String*s are not convenient for several reasons: for example, passing them around is rather inefficient and existing C functions expect *char* * objects, not *String* objects.

(Also note that we have restricted *String*s to 255 characters – reasonable as that size may seem, one day it will be too small.)

Instead, we can allocate store for the new string dynamically, from a pool of store maintained by the C implementation. Here is the revised definition of *append*.

```
#include <string.h>
#include <stdlib.h> /* For malloc
    */
char *append( char *one, char
                               *tother )
    {
    char *result = (char *)
     malloc( strlen( one ) +
           strlen( tother ) + 1 );
    strcpy( result, one );
```

```
    strcat( result, tother );
    return result;
    }
```

malloc is similar to BASIC's *DIM Variable* statement or Pascal's *new* procedure. Its argument is the number of chars worth of space to allocate. It is an *unsigned* integer (which means that trying to pass it negative numbers will be treated as asking for amazingly large amounts of store). We need enough space for all the characters of *one*, plus all the characters of *tother*, plus one for the 0 character that terminates C strings.

malloc's result is a pointer of type *void**, which you may remember means "pointer to anything". For clarity it is best to cast it to the right type as soon as possible.

Not all the world's a string

Of course, the use of *malloc* is not confined to making strings. In fact, that is probably one of its less common uses – outside demonstration programs, anyway. Most of its uses can be characterised as making instances of data-types – delivering store to be used to represent a value of some type.

Let us consider that venerable data-type, the **linked list**, or just "list" for short. A list is a sequence (a collection in which the order matters) organised for access in a particular way. It is either **empty**, i.e. containing no elements, or it has a **head**, which is an element, and a **tail**, which is a list containing the remaining elements. There is a function **cons** which takes a list and an element and delivers a new list of which the element is the head and the (old) list is the tail.

Here is an implementation of linked lists for C. In line with previous articles, it is divided into two parts – a header file, *#included* by other modules that wish to use list facilities, and a main file containing the definitions of the required functions.

In file "h.lists":

```
#ifndef H_LISTS
#define H_LISTS
typedef enum {FALSE, TRUE} Bool;
typedef struct list_struct *List;
#define NULL_List ((List) 0)
extern void *head( List l );
extern List tail( List l );
extern List cons( void *h, List l );
extern Bool isempty( List l );
#endif
```

This uses the mechanism discussed in Part 6 to allow "h.lists" to be included many times without errors. The *typedef* works as discussed in Part 3 but with the following new twist: there is (presumably) no definition for the structure tag *list_struct* when this code is compiled. In this case, the structure type is incomplete – it can only be used in places where its size is not needed. Fortunately, defining pointers does not need this information, so the type List is legal as "pointer to incomplete *struct*".

This means that modules that *#include* h.lists cannot declare any *struct list_struct* objects (because that would need to know their size) or access any of their fields (because their names and types have not been revealed). This allows the implementation of lists to do as it pleases without fear that code elsewhere will be affected.

The empty list is traditionally represented by a null pointer and so we define a constant (macro) *NULL_List* with the right type. Then we have the declarations for the list operations. Note that the elements of the list are typed as *void** – this means that they can be any pointer type. Unfortunately this means that they cannot (portably) contain integers, reals or characters but that's life.

"c.lists" starts with a collection of *#includes*; our old friends "assert" and "stdlib" – the latter supplying the declaration for *malloc*.

```
#include "lists.h"
#include <assert.h>
#include <stdlib.h>
```

The structure type is now completed; it has two fields, one for the head and one for the tail. The rest of the module can now refer to the components of the structures pointed to by *List* objects.

```
struct list_struct
    {
    void *head;
    List tail;
    };
```

The *isempty* test simply requires testing against the null pointer.

```
Bool isempty( List l )
    {
    return l == NULL_List;
    }
```

head and *tail* simply return the appropriate components of the structure, after ensuring that the list is not empty. Note that it is good practice to use *isempty* as the test, not equality with *NULL_List*. This ensures that it is possible to change the definition of emptiness in as few places as possibly, should such a change be required.

```
void *head( List l )
    {
    assert( !isempty( l ) );
    return l->head;
    }
List tail( List l )
    {
    assert( !isempty( l ) );
    return l->tail;
    }
```

Well, now we can examine lists but the only one available is the empty list. Furthermore, we haven't actually used *malloc* yet. Let us remedy both omissions by exhibiting the code for *cons*.

```
List cons( void *h, List l )
    {
    List result = (List) malloc(
     sizeof( struct list_struct )
     );
    if (!result) abort();
    result->head = h;
    result->tail = l;
    return result;
    }
```

We must allocate just enough store for a *struct list_struct*, which requires knowing its size in bytes. The C operator *sizeof* is a compile-time operation that returns the size of the type or variable which it is supplied, in units appropriate for *malloc* (usually thought of as characters). *malloc* might return NULL (see below): in that case – for want of a better solution – we abort the program. Otherwise we copy the arguments to the corresponding fields and return (the pointer to) the allocated store as our result.

Lists are useful when a collection of elements must be built up piecemeal (and hence their number is not known in advance) and they can be processed in order (no hopping about between elements).

Running out

Clearly, since the store of the machine is not only finite but quite small, eventually *malloc* could be unable to satisfy a request for any store. In these circumstances, rather than falling over with some error message, it simply returns a null pointer – *(void*)*0 – and leaves it to you to decide what to do. This means that it is wise to use *malloc* only from within your own function of the form:

```
void *my_malloc( unsigned n )
    {
    void *result = malloc( n );
    if (result) return result;
    else ...;
    }
```

where the "..." stands for whatever you wish to do in the circumstances (abort the program, ask for less space, save the current state and restart the program, etc). Otherwise you should check each result to ensure that it is not null.

Of course, when you have finished with a piece of store, it is only polite to hand it back so that it can be re-used. This is the job of the function *free*. When applied to a pointer, it returns the store to the free pool that *malloc* uses. Note well: you should only give to *free* a pointer that has been given to you by *malloc* and not already freed. (As a particular case, you can free a null pointer – nothing happens.) Once a pointer has been freed, any other pointers pointing at, or into, the freed store must no longer be used. The penalty for breaking these rules is that your program may then exhibit undefined behaviour.

If you happen across pre-Ansi programs (particularly those built under certain flavours of Unix) you may find these rules being freely broken because that version of *free* did not trash returned store until the next *malloc*. Such code was never portable – do not trust it.

If you try writing code using *malloc* and *free*, you may find that it is quite difficult to keep track of just when a piece of store has been finished with. Do not be alarmed: it really is difficult. There are two opposing mistakes that can be made:

One is to free store that is still in use. This will often cause *malloc* to fall over in an obscure fashion later

on, as you cheerily write over the secret information it uses to keep track of what's where. Or your program behaves in a most peculiar fashion, as *malloc* writes over the store and hands it back, then the program has two conceptually distinct pointers that happen to point to the same place. Chaos ensues.

The other is to omit to free store that has just become inaccessible. Usually, nothing visible goes wrong, until you run out of store unexpectedly. This is really difficult to track down because it is much harder to find a place where nothing is happening (although it should) rather than a place where something wrong is happening. When a program runs out of room like this, it is said to have a store leak.

There is no simple solution (other than switching to a language like Lisp, where store de-allocation is taken care of for you). You must decide on a policy to be followed for your use of store and stick to it ruthlessly. A policy is just a set of rules for keeping track of the "owner" of a piece of store and deciding when the store can be freed.

By "the owner" we mean the function or data-structure that has the responsibility for freeing it when it is no longer needed. This responsibility can be transferred; part of the description of a function or data-structure is how it handles responsibility for store. We'll discuss a concrete example: the case of *List*s.

Freeing lists

isempty is best treated as a "don't care" function: it just reports on whether the list is empty or not. This is reasonable, as the point of *isempty* is to see what the list is like – it is unlikely that *isempty* would be called on a list and then the list ignored regardless.

head and *tail* are another matter. For both of these functions, their caller may have no other use for the list once it has been (be)*head*ed or *tail*ed, so this might be the last remaining reference to the (front of the) list. Hence it should be possible to free the list. On the other hand, it should be possible to keep it too. The most sensible way to do this is to pass an additional parameter, saying what the responsibility of *head* and *tail* is toward the list. In "h.lists" we add:

```
typedef enum {ARG_KEEP, ARG_FREE}
    ArgTreatment;
```

which is intended to be used to describe how an argument is to be treated by a called function – *ARG_KEEP* if it is to be kept (not freed) and *ARG_FREE* if it can be freed (it need not be, if the called function wishes to keep it somewhere else).

```
extern void *new_head( List l,
    ArgTreatment t );
extern List new_tail( List l,
    ArgTreatment t );
```

These are versions of *head* and *tail* which take an extra *ArgTreatment* telling them what can be done with *l*. We retain the old versions of *head* and *tail* because there are times when we know that we want the list preserved regardless.

```
extern void free_list( List l );
extern void free_list_front( List
    l );
```

free_list will free an entire list and *free_list_front* will throw away the first *struct list_struct* of a list.

```
extern void *dest( List *l );
```

Finally, *dest* will take a *pointer to* a list, deliver its head, adjust the pointed-to list to point to its tail and free the list front – all in one go. This can make the job of traversing a list for the last time (when it is just about to be freed) easier.

To implement these we add to "c.lists":

```
void *new_head( List l, ArgTreat
                            ment t )
    {
    void *result = l->head;
    if (t == ARG_FREE) free( l );
    return result;
    }
List new_tail( List l, ArgTreat
                            ment t )
    {
    List result = l->tail;
    if (t == ARG_FREE) free( l );
    return result;
    }
If the list argument may be
                        freed, it is.
void free_list_front( List l )
    {
    free( l );
    }
```

```
void free_list( List l )
   {
   while (!isempty( l ))
      {
      List temp = l;
      l = l->tail;
      free_list_front( temp );
      }
   }
```

free_list walks along the list, freeing each cell. Note the care taken in the *while* loop to avoid referring to the contents of the list once it has been freed. The instantly obvious code

```
free_list_front( l ); l = l<-
    tail;
```

is wrong and will fail to work in many implementations of C.

```
void *dest( List *l )
   {
   void *result = (*l)->head;
   List next = (*l)->tail;
   free_list_front( *l );
   *l = next;
   return result;
   }
```

The same care must be taken in *dest* to extract the contents of the list front before freeing it.

The begged question

You may have noticed that, although we have carefully provided for freeing the *List* structure, we have provided no control over the freeing of the list elements. This is a difficult issue. Generally speaking, when a structure is freed it should in turn free those of its sub-structures that "belong" to it. However, these structures may be shared elsewhere, in which case this would be disastrous.

In the case of *Lists*, the simplest thing to do is to leave it to the caller – to disavow any responsibility for the contents of the list. Since lists may contain elements of arbitrary type, this is the position of least commitment.

Exit

More on store allocation and deallocation in the next article, when I shall introduce *realloc* and discuss the relationship between *malloc*, pointers, and arrays.

A310 Memory Upgrades

Paul Beverley

As more powerful applications are becoming available, owners of A310's are finding themselves short of memory. For example, Laser Direct needs 2M to run at all and Beebug's Ovation DTP won't allow you to use the spelling checker if you only have 1 Mbyte. The CJE Micros' upgrade has been available for a long time now but it involves desoldering memory chips and replacing them with sockets that will provide contact for the new memory board and many people are not keen on that idea.

Several companies have been threatening to provide solderless memory upgrades for a long time and they all seem to have come up against problems but now, at last, there are three possibilities. In this article, I shall be comparing the memory upgrade boards from Computerware, Protokote and Watford Electronics.

Construction

All three boards are similar in that they use a carrier board that goes over the MEMC socket. You remove the MEMC and put it in the carrier board, then plug the carrier board into the MEMC socket but this does not supply all the address and control lines necessary. To get the extra lines, Watford have chosen one technique and Computerware and Protokote have taken a different route. Watford have used a second carrier board, using the same technique as the MEMC board, but fitting on the VIDC chip socket. This is then joined to the other board by a piece of ribbon cable that tucks neatly out of the way along the side of the main p.c.b.

The other two manufacturers have chosen the same "two birds with one stone" technique. They have provided a p.c.b. which plugs into the O.S. ROM sockets. This means that if and when Acorn produce the new O.S. ROMs (see the comments on page 4) you will be able to take advantage of them. In the case of the Computerware board, this will just mean pulling out the old ROMs and plugging in the new

ones but with the Protokote board there is some work to do first. Their manual says, "Some soldering and track cutting will be required to allow the fitting of larger sized ROMs". They explain what needs doing but suggest that it ought to be done by a dealer. I agree and would add that it has to be done by a dealer who is also a "Component-level Service Centre" (which N.C.S. is not).

The actual memory chips, in the case of the Watford board, are on the MEMC board whereas Computerware have put them on the O.S. ROM board. Protokote have used a third board to carry the extra memory thus increasing the construction cost but enabling them to keep the memory board more out of the way. On the Watford board, the ram is upside down in close proximity to the ARM chip (so you cannot fit an ARM3 upgrade). I have real reservations about this technique in terms of heat dissipation – especially on the 4M board. It is the same technique that Watford have used for its ARM3 upgrade. They must think it is OK, but I must say I am a bit dubious. (See also my comments on ARM3 upgrades in the Comment Column on page 11.)

All three manufacturers have used good quality four-layer p.c.b. for the memory boards but one other difference between them is that Watford and Computerware have used a separate power cable. Protokote take their supply directly from the O.S. ROM board along the ribbon cables. This seems a little dubious and may explain why they have provided such a short cable here. You almost have to stretch the cable to get it to connect between the two boards. They have supplied an extra ground connection with a rather unusual five pin connector which fits on PL2 on the main p.c.b. This is the "auxilliary audio connector" which I have never seen anyone using, but you will have to do a bit of soldering if the connector has already been used.

One other difference in construction is that Protokote have used the more familiar dual-in-line chips rather than the sideways-on zig-zag chips that the others use (and as Acorn have used on the A410's.) This means that the Protokote board is the largest of all the boards but they have cleverly tucked it out of the way by putting it on its edge, along the side of the metal case. It has a hole in the middle of it through which the metal support bar of the backplane (if you have one) fits.

ARM3 compatibility

As I have said, neither the Aleph One nor the Watford ARM3 board will fit with the Watford memory upgrades. I checked each of the other boards and found that with the Protokote board, the Aleph One ARM3 would **just** fit – though it is tight and you need to put a piece of thin, strong plastic sheet between the memory upgrade and the underside of the ARM3 board – otherwise they will short out on each other. The Watford board, with the ARM3 hanging underneath it, will not fit with the Protokote board – it would have needed an extra couple of millimetres clearance to make it possible.

The Computerware MEMC board is almost identical to the Protokote one and, in fact, the same applies – the Aleph board **just** fits but the Watford one doesn't. Computerware were aware of the potential problems of shorting out on the ARM board and so are fitting a piece of insulating material as standard. They also say there could be a problem with the ARM3 upgrades that used the old type of header (you can recognise them because the headers are black) because they are a different height from the later ones. However, they say they will arrange some sort of swap if necessary.

Quality of construction

Of the three boards, the Watford one must have been the cheapest to construct. The memory chips are soldered in, rather than using sockets, and the headers used to connect with the VIDC and MEMC are poorer quality than the ones used on the other boards as are the connectors used for the ribbon cables. The most expensively made is the Protokote board as it uses sockets – and high quality turned pin sockets at that – for all the memory chips, even the first Mbyte of memory which could easily have been soldered in.

Fitting

The Protokote and Watford boards come with full fitting instructions though Watford's is rather easier to follow as it has several good diagrams. The Watford boards are probably the easiest to fit because they don't have a ROM board carrier. These carriers have 128 pins which have to be carefully lined up with the 128 holes in the ROM sockets and then pushed (quite hard) to get them to fit in firmly. In all cases, the main p.c.b. has to be

removed which is a fairly major undertaking unless you are sure what you are doing, so think carefully before undertaking a D.I.Y. upgrade. It doesn't half make a mess of your board if you put the power connectors bakc the wrong way round, for example!

Upgrading

If you buy a 2M board and want to upgrade to 4M, in the case of the Watford board, you have to do a complete board swap as there are two entirely separate ram boards for 2 and 4M. The Protokote one is easiest to upgrade from 2 to 4M as it is socketed throughout so you just have to plug in the new ram chips and change a link on the board. They even tell you which chips to use so that you can go out and buy them yourself, perhaps cheaper than Protokote would supply them. Mind you, they do say that they "can only guarantee correct operation of this ram upgrade if Fujitsu ram chips are used". This worries me slightly as a memory board worth its salt should work with any manufacturer's memory chips so long as they are fast enough (100 ns). The Computerware board has the memory chips soldered in and so, for upgrading, you have to return the computer (or the board) to Computerware to have the extra chips added. The reason they have not used sockets is that the board goes under the podule slots and the extra height of the sockets would cause it to foul underneath the podule in slot zero.

Price

The prices of the three upgrades are as follows. All these are Archive members' prices and include VAT and U.K. carriage. N.B. The Computerware price includes free collection, fitting and return delivery by over-night carrier. If you want to fit the Computerware one yourself and you have the necessary chip extraction tool, you can take £16 off the price. Computerware's price also includes a replacement MEMC1a chip.

	2M	4M
Computerware	£380	£580
Protokote	£375	£570
Watford	£330	£575

Availability

The Watford boards are in stock at N.C.S., the Protokote boards are available from the distributors so we can get them within a few days and the Computerware upgrade is "nearly ready – just a few days now"! Computerware have been saying that the upgrade is "nearly ready" for quite a while and, at the time of writing, they are still not actually available. The review was done with a prototype board and a look at the drawings of the production boards. Theoretically, by the time you read this, they should be ready!

Conclusion

As you will have gathered, I tend to favour the Computerware upgrade even though it is, apparently, the most expensive. Remember though that the price includes fitting and a free MEMC1a upgrade. The Protokote board is well made but I am a little wary of the design. (I am an Electronics Engineer by training, in case you were wondering.) Computerware's upgrade seems to be better designed and is compatible with the Aleph ARM3. Also, you have the peace of mind of knowing that if Computerware does the upgrade, and anything goes wrong, they will fix it for you. A

DTP Column

Ian Lynch

Firstly some problems solved and then some hints and tips from other members. Tim Hubbard had a print problem from Acorn DTP which I also found a problem. This was that the machine hung up after a page was printed. He has found the solution. A revised version of PrinterDM on the RISC-OS update disc (available as Shareware 17) seems to have solved the problem. Now (according to me) PrinterDM latest version is 1.12 July 1989 but without ringing Acorn I wouldn't like to bet my life on it! It just shows that it is important to install !System extras and new versions as they become available. Hopefully these things will become more stable from now on.

Stephen Bolton provides help with printing envelopes with a Deskjet+ using Impression. First use 22cm wide envelopes and define a new master page

by using Menu – Edit – View master pages – Menu – Edit – New master page. Now use the dialogue box to set the page to the correct dimensions. (Click the custom button). You will receive the message that you have just created master page 17. With the arrow in the main document window do: Menu – Edit – Alter Chapter and type 17 into the Master page slot in the dialogue box and click OK. You have now redefined the pages in your document to fit the size and shape of the envelope. However, the principle can be applied to any page layout (eat your heart out users of Wordperfect 5.1).

On the same point, Tim Powys-Lybbe has supplied a ready-made master page and two RISC-OS utility programs to enhance Impression. A word of warning though, Stephen Bolton points out that in his experience the Deskjet chews up about one envelope in 4 and that the paper handling mechanism may not stand up to envelopes too well. Also bear in mind that the use of indelible inks may clog the print head and only HP ink cartridges are guaranteed. Incidentally, the protocol do: Menu – Edit, etc for explaining operating sequences was suggested by Steve Kirkby and I shall use it where necessary. Any comments or suggestions on the "Kirkby protocol" would be appreciated.

Impression enhancements

It has been pointed out that there is no mail merge option with Impression – something commonly found in wordprocessors. I have just had to merge the names of students and their tutor groups with a front page graphic for their annual report. To print a full graphics page and the text for 200 students would have taken forever, so I used !Draw to design the graphic and the reprographics people produced 200 copies of the page. I then wrote a short program to take names and tutor group data from a file inserting enough carriage returns in the right places so that the names were in the correct place on an Impression document page. Now Impression uses a "Document description language" which is documented at the end of the manual, so that you can for example, enter {\123}"Main Heading" on} in your text to switch main heading style on, {\123}tab} to insert a tab, etc so that it is not too difficult to produce a text file which, when dropped into an Impression window, produces the names in a fancy font in the correct place on every page. These can now be printed directly on top of the duplicated covers providing a personalised cover for each student.

Another way of doing this sort of thing is to link frames on different pages so that text will flow between them in the correct way. This is all rather esoteric but do write if you would like to know more about file handling in this way and if there is enough interest I will go into more detail.

DTP utilities

CC are working on several utility programs which should enhance Impression further. Mathematical DTP is one and if the results are anything like the printed demo they have sent to me, writing mathematics and scientific texts should become a doddle. A table creator also seems likely, so that the lack of line drawing facilities will no longer be a detraction. Charles Moir's philosophy is that to get the best out of RISC-OS an application should not have features easily replicated by another program. By writing a RISC-OS table creator, users of Acorn DTP, Ovation and Tempest would benefit also and Impression will remain compact and usable on a 1M machine. I have to agree with this.

My experience with MS-DOS programs is that large chunks of them are replicated in many other packages (but not consistently from the users' point of view) which is the worst of all worlds. Greater expense in production, being more difficult to learn, the size of many of these all make a hard disc essential rather than useful and it is awkward to pass data between programs. RISC-OS ensures that the utility of the total resources is greater than the sum of the individual parts (synergy, I think they call it) and we all need to adopt the RISC-OS mentality.

Four DTP's

I have just received a pre-release copy of Ovation. My first impression (no pun intended) is that it is fast and easy to use. It is about 100k bigger than Impression and this is without the spelling checker (not yet implemented) so 1M users are going to find it a squeeze. Having said this, it is still 100k more compact than Acorn DTP and seems to offer more. A couple of features not in Impression are a line drawing facility, timed automatic backup and a clip-board viewer. However, there are many features such as virtual memory, index compiling and

Acorn Outline fonts which seem to be missing. Menu options are much more lengthy which on the surface makes one think there are more features, but Impression is designed to minimise the number of options on menus and place options on dialogue boxes, so this is not necessarily the case. It is to retail for £113.85 and, as far as I am aware, is not copy protected.

I will do a full review (or perhaps someone else would like to) as and when I get hold of a full release copy. With Tempest also about to be released, Archimedes owners will have the choice of four full feature DTP systems, (5 if we count Impression professional which is to be released as a more fully featured version of Impression for professional users) with Draw, First Word Plus and PipeDream offering some DTP features.

Impression, written in assembler, is likely to be the most compact and quickest with perhaps the most professional features but, at the same time, it will be the most expensive. Ovation and Acorn DTP are both written in C but Acorn DTP is a port whereas Ovation was written for the Archimedes and is likely to be quicker and more flexible. Tempest is being written in BASIC and assembler and seems to be an Acorn DTP clone which addresses many of the problems for which Acorn DTP has been criticized.

I only hope all the companies concerned make a reasonable profit from their products so that they provide us with more "goodies" in the future. Acorn DTP is looking a bit sad now so Acorn need to release a new version to compete. Perhaps the other companies will offer discount for Acorn DTP trade-ins and let Acorn concentrate on a different area. After all we now have Wordprocessor/DTP facilities as-good-as if not better (especially at the price) than on any of the other machines. The same is not the case with all other areas, so I would rather see the gaps filled than simply more graphics and DTP packages.

Impression keystrip

A late entry from David Turner is a keystrip prepared on Impression. It comes in one version with the words for Impression and one with the words for PipeDream 3. However, having been done in Impression it is much easier (than previous keystrip offerings we've had) to change the text in the boxes for whatever application you want to use. (Available on this month's program disc.)

Impression masterpages

Finally, some comments from Ray Dawson...

One of the areas not well documented in the manual is how Impression master pages may be altered, created and saved for later use.

Master pages are contained in an application called !Default, which is inside the Auto directory within !Impression. Click on !Default and you will be presented with the default master page in the Impression window. This master page may be changed by means of the Alter chapter facility in the Edit menu. If, for instance, you require a two column A4 master page whenever Impression is booted up, select master page 5 in the Alter chapter dialogue and re-save the !Default application. Next time Impression is booted, this will be the default master page presented.

Customised master pages may be created using the New master page option. Use the New master page dialogue box to create the page layout you require and click OK. You are now told that you have created a new master page, number 17 if it is the first one you have created. This will appear as the last page in the master page window and you may now add any text or graphics that you require, say your address or the layout of a commonly used form. One important point is that you will not be able to alter or add to text in a master frame when it is used in the Impression window. You may, for instance, have a frame with the word 'Date' in it. If you wish to add the date in documents based on this master page, a blank frame must be created for it by the side of the 'Date' frame.

Any number of new master pages may be created in the same way. Re-save the application !Default and your new master page is saved in it and will be available next time Impression is booted.

Styles may be altered, created or removed in the same way. If, for example, you don't want 'Typewriter' as a style, load !Default and delete it from the style menu presented in the Master page window. New styles may be created and added to the style menu and these will be saved when !Default is re-saved. A

Optimising 'C' Programs

Keith Marlow

In this series of articles I shall endeavour to explain various techniques which allow you to speed up your C programs. Some of the techniques can also be applied to other languages but C, because of its low level nature, allows the programmer great control over the actions of the final program, thereby allowing you to make optimisations that would be impossible to perform in other languages.

The techniques below make use of the fact that you, the programmer, can easily identify the interdependencies that exist between program statements when they are executed. This ability to detect such interdependencies is something which most of today's generation of compilers can only touch the surface of, so even if your compiler optimises, there is still room for improvement.

It must be noted that you should have a good working knowledge of C. If not, I suggest you read the articles 'Introduction to C' by Chris Dollin that started in Archive 3.1 page 24.

An important warning

Before using any of the following techniques, I would strongly advise you to check that your program contains no known bugs! As you can probably imagine, optimising a program with bugs in it will only compound the task of debugging it later. Secondly, you should make and keep an original copy of the program. This is so that, if you make a mistake while optimising, you will have something to fall back on. Also, keeping an original is useful when you produce documentation as this will be easier than documenting the optimised program.

Identifying the inefficiencies

Generally, if a program is inefficient, there usually exists specific areas in the program which contribute more to the inefficiency than others. They can usually be identified by the fact that they consist of repeated code as part of a loop. Such loops consist of the following parts:

- An initialisation section – This is usually not worth much consideration as it is only executed once for many iterations of the loop, but it becomes important when it is part of a nested loop.
- The statements in the loop – These statements (with the termination check) form the section most worth optimising.
- Loop termination check – Whether this check appears before or after the statements in the loop doesn't matter. What is important is that it is performed once for every cycle of the loop making it at least as important as the statements in the loop.

Importance of the loop termination check

Suppose we have two loops which use the same loop termination check but which are of different sizes, e.g.

Loop A
Termination check cost = 10
Inner loop statement cost = 40

Loop B
Termination check cost = 10
Inner loop statement cost = 90

In loop A, termination checking accounts for 20% of each loop cycle while in loop B it accounts for 10%. Suppose now that, by performing some optimisation, we could reduce the termination check cost to 5. In loop A, the termination checking goes down to 10% while in loop B it goes down to 5%. This means that a saving on termination checking is more effective on a smaller sized loop.

Unfortunately, the above situation of two different loops sharing the same termination check doesn't often occur in real life. It more realistic to have many loops with different sizes and different termination checks. Taking into consideration the above, the following ground rule of optimisation can be deduced:

Only bother optimising loops which either have high termination check costs or loops which have many iterations.

Optimisation of loop termination checking

In order to explain what is happening, I shall use the following snippet of code:

Program BinA

```
int high = TOP,
      low = BOTTOM;
int found = 0;
```

```
while( !found && ( high <= low) )
    {
    int half = ( high + low )/2;
    if(array[ half] < VALUE)
      low = half + 1;
    else
      if(array[ half ] > VALUE)
        high = half - 1;
      else
        found = 1;
}
```

This is an implementation of the standard binary search routine. The variables in upper case are assigned externally (TOP, BOTTOM = bounds of array, VALUE = value being searched for).

By looking at the termination checks, we can see that we are checking to see if:

a) the value has been found, or,

b) high < low.

By doing some hand runs of the routine, it can soon be seen that the value of variable found doesn't change until the required value is found, which then terminates the loop regardless of the values of high or low. Therefore its value can only possibly change in the last iteration of the loop, so why are we checking it at every iteration? This can therefore be sighted as an inefficiency. In fact, any such check where one variable can independently terminate the loop can usually be cited as an inefficiency.

Using a goto

The above inefficiency can be removed with the help of the goto statement. Now before everybody jumps up and shouts 'Oh no, not a goto statement!', note should be taken of the points I made in the warnings section. If these points are followed, then the person reading the documentation will never need to know about any goto's, only the original programmer will know.

Where should the goto be put? Ideally the goto must originate from where the found variable was made true and jump to a point immediately after the loop. By doing this, we are in effect jumping over the termination check, which we know will be true anyway. It is important to remember that this 'jump' can only be done if, when 'jumping', it is not possible to miss statements in the loop which could have been executed. Otherwise, such a jump would unpredictably change the behaviour of your program!

The program BinB below shows the use of a goto.

Program BinB

```
int high = TOP,
     low = BOTTOM;
while( high <= low ) {
    int half = ( high + low )/2;
    if(array[ half] < VALUE)
      low = half + 1;
    else
      if(array[ half ] > VALUE)
        high = half - 1;
      else
        goto found_jump;
}
found_jump:    ...
```

Usually with loops that terminate in such a fashion, code with the structure below follows it :

```
if(found) {
   ... /* performed when found */
}
else {
   ... /* performed when not found
                                  */
}
```

This will have to be altered because it refers to variable found which isn't used any more, but the position to which the goto jumps can be used to replace the condition as follows :

```
/* performed when not found */
goto found_end;
found_jump:
/* performed when found */
found_end:
```

In effect, we are serialising or flattening out the path of execution. By performing this optimisation, the number of termination conditions have halved, the test of found after the loop has been removed and the variable found has been removed – quite a reduction gained from the introduction of one goto statement!

Variable elimination by duplication of code

This optimisation is where a variable which controls the execution of statements in a program is removed by the duplication of those statements.

This optimisation is only useful if either the assignment to, or checking of, this variable is costly.

I shall use an example taken from Donald. E. Knuth's paper 'Structured Programming with goto Statements'. The example is a routine which partitions an integer array N [1 .. n] into two parts. The left part N [1 .. j-1], for some j, will contain all the elements of N less than some variable v; the right part N [j+1 .. n] will contain all elements greater than v; and the element N [j] is equal to v.

Partitioning is performed by searching from the left until an element greater than V is found, then searching from the right until an element less than v is found, then searching again from left, then from the right and so on, each time moving the found elements to the opposite end of the array, until the two searches meet. A boolean variable right is used to determine which search is in use.

Program ParA

```
int i, j, right = 1;
while( i < j ) {
    if( right ) {
      if( N[ i ] > v ) {
        N[ j ] = N[ i ];
        right = 0;
    }
    else {
      if( v > N[ j ] ) {
        N[ i ] = N[ j ];
        right = 1;
    }
    if( right )
      i += 1;
    else
      j -= 1;
}
N[ j ] = v;
```

As can be seen, the assignment to, and testing of, right takes up a large proportion of the time. In this case, right can be removed by using the program counter to mimic right's action upon the execution of the program i.e by duplicating the statements conditionally executed. In this case, one section can represent the actions performed when right is true and another section represent the actions performed when right is false. Program ParA is transformed as:

Program ParB

```
int i, j;
do{
    if( N[ i ] > v ) {
      N[ j ] = N[ i ];
      goto left;
    }
    right:
    i += 1;
}
while( i < j );
goto end;
do{
    if( v > N[ j ] ) {
      N[ i ] = N[ j ];
      goto right;
    }
    left:
    j -= 1;
}
while( i < j );
end:
N[ j ] = v;
```

This program is very difficult to understand, mainly due to the fact that it jumps into the middle of while loops, but it must be remembered that an understandable transformation was used on a previously understood program to produce this program. This program will most definitely run faster and probably won't take up much more space as the assignments and condition tests have been reduced.

Removing unnecessary duplication

Duplication can occur anywhere in a C program, but as above, the best place to start removing such duplications is in loops.

Duplication in C can be split into two types: Duplication of expressions and duplication of work in assigning to, and reading from, variables.

Duplication of expressions

This type is probably the easiest to spot because the finding of duplication of expressions is just a case of reading through the listing. In program BinB, it can

easily be seen that the expression 'array[half]' occurs twice.

Now before anything can be done about this, it is important to perform a few checks to make sure that any values used in such expressions don't change between them. If the values could possibly change then the following optimisation could not be performed as it relies upon this invariant fact.

The optimisation simply consists of creating a variable and assigning the result of the first expression to this variable, then using the variable in place of the other expressions. This transformation is shown below:

Program BinC

```
int high = TOP,
     low = BOTTOM;
while( high <= low ) {
    int half = ( high + low )/2;
   int array_value = array[ half ];
    if(array_value < VALUE)
      low = half + 1;
    else
      if(array_value > VALUE)
        high = half - 1;
      else
        goto found_jump;
}
found_jump:    ...
```

This optimisation is particularly useful in that it increases speed and also often results in a reduction of the size of the program, due to the fact that the space taken up evaluating an expression is more than that taken up by storing its result.

Duplication of work in assigning to and reading from variables

This type is a little bit harder to spot. It usually consists of an assignment to a variable immediately followed by this variable being used as part of some expression. In the above program we can see that variable half is used in the assignment to array_value and also that array_value is assigned then used in an expression.

Now, as with type A, there should be no change in the values used in the assignment to a variable and where that variable is first used. If this condition holds, we can make use of C's ability to perform an assignment from within an expression as follows:

Program BinD

```
int high = TOP,
     low = BOTTOM;
while( high <= low ) {
    int half;
    int array_value;
    if( (array_value = array[
    half = ( high + low )/2 ]) <
                          VALUE )
      low = half + 1;
    else
      if(array_value > VALUE )
        high = half - 1;
      else
        goto found_jump;
}
found_jump:    ...
```

This optimisation can result in problems due to side effects (see Introduction to C – Part 7, Archive May 1990). To be safe, I use the rule of not using this optimisation where the variable is used more than once in an expression. If the variable is used more than once in a condition, put the assignment in the leftmost use of the variable, so ensuring the assignment is performed before the variable is used. (Remember, logical operators perform their left operand before their right operand.)

As can be seen the two types of duplication can usually be combined to yield some quite significant savings indeed.

Coming next

In the next article, I shall explain how to make the use of register variables and the internal format of the data structures. If you have any problems, queries or suggestions with respect to the optimisations above, I can be contacted on Archive BBS (user number 224) or write to me at 21 Courtenay Close, Bowthorpe, Norwich, NR5 9LB.

Useful books & papers

Koenig, Andrew: "C Traps and Pitfalls", Addison-Wesley.

Knuth, Donald.E: "Structured Programming with goto Statements", Computing Surveys, pp 261 – 301, Vol. 6, No. 4, December 1974.

Purdum: "C Programming Guide", Que. A

Stylus – Primary Wordprocessor

Alan Wilburn

Stylus is a word processor for primary school children. It comes in a strong folder containing a disc, manual, sample printout and Concept Keyboard overlays. The program is loaded by booting or clicking on the application. When it is loaded (my review copy didn't like mode 15) the grey, picture-framed writing box appears, taking up most of the screen. Text entry is straight forward and immediate, appearing in blue – which is clear and distinct. Cursor movement is by the mouse or the normal arrow keys with <shift-arrow> moving the cursor along lines and to the top and bottom of the text. <ctrl-delete> removes lines whilst <tab> toggles insert/overwrite modes. There is a set of embedded commands available to change fonts / sizes / densities for titles or to use the supplied border font within the same document.

The menu is accessed via the mouse using the normal conventions. Clicking Menu brings up a set of icons which, when pointed at, cause a hand to appear and point with the relevant information displayed by it: Select chooses – Adjust aborts. The options to save and load are easy to use: selection is by mouse and a dialogue line to save files.

The print menu gives three sizes, four fonts and a choice of three print densities. There is a definable default setting to customise the program. The three print sizes give 14, 24 and 33 cpl – my own preference is the medium setting as this is the WYSIWYG configuration (the different fonts are on printout NOT on screen).

The concept keyboard was covered in detail in Archive 3.4 page 58 but as a reminder – it is an A3 or A4 board with 128 switches under rectangular cells. Each switch can be programmed to give an input of information – with a WP it is normally some form of text that is entered. The text can be a lexicon, sentence matching, sequencing or block insertion of sentences/phrases to name but a few. There are two 'overlays' needed: a paper overlay for the top of the keyboard giving the words/pictures and an overlay program for the cells.

The concept keyboard menu gives you saving/loading options, printout of the messages in the cells and making an overlay. The overlay making page is excellent with a picture of a keyboard complete with cells. Editing of existing overlays can be via the mouse but the best way for new overlays is from the concept keyboard so they match up with the prepared paper template. Function keys are set up so that arrow keys/Return/Delete cells can be programmed – an omission is the lack of Shift. To program a section of the board press the top left area of the required block type in the text and touch the bottom right corner and the text is entered.

I would recommend Stylus as a cheap (£15) and easy to use program for the A3000's now appearing in schools – my school uses the BBC version throughout the school with great success. I look forward to the more advanced version which is due later in the year from Northern Micromedia. A

Competition Corner

Colin Singleton

A geometrical problem this month, but not another of those pencil-and-paper jigsaw puzzles. To get the feel of it you may need some squared paper (graph paper, but with larger squares), but to enter the competition you will certainly need an Archimedes.

Given a sheet of squared paper it is easy enough to draw a small circle which passes through four grid points. Taking the side of each square as unit, the smallest possible has its centre at (1/2, 1/2) and has radius $\sqrt{(0.5)}$.

With a moment's thought you can draw a small circle passing through three grid points, but not four. For example, one passing through (-1,1) (1,1) and (0,-1). This has it's centre at (0,1/4) and radius 5/4. This, however, is not the smallest possible three-point circle.

You have to find and list the centre and radius-squared (to avoid square roots) of the smallest N-point circle, for values of N starting at two. The winner will be the one who produces the longest list for consecutive values of N. Solutions for higher (non-consecutive) values may be used as tie-breaker, as may run time.

Entries (printed list please) and comments either via Paul at N.C.S. or to me at 41 St Quentin Drive, Sheffield S17 4PN.

The winner of the April (Easter Day) Competition should be announced next month. It is clear that quite a bit of work is still being done on the May (Perfect Numbers) problem, so I will keep that one open for a while.

(In future we will be giving a regular £50 token to each month's winner. Ed.) A

Fact-File

(The numbers in *italic* are fax numbers.)

4mation	Linden Lea, Rock Park, Barnstaple, Devon, EX32 9AQ. (0271–45566)
628 Software (p24)	24 Mulgrave Road, Whitby, N Yorkshire, YO21 3JS. (0947–602756)
Abacus Training	29 Okus Grove, Upper Stratton, Swindon, Wilts, SN2 6QA.
Acorn Computers Ltd	Fulbourn Road, Cherry Hinton, Cambridge, CB1 4JN. (0223–245200) *(–210685)*
Aleph One Ltd	The Old Courthouse, Bottisham, Cambridge, CB5 9BA. (0223–811679) *(–812713)*
Apricote Studios (p9)	2 Purls Bridge Farm, Manea, Cambridgeshire, PE15 0ND. (035–478–432)
Arxe Systems Ltd (p15)	P.O.Box 898, Forest Gate, London E7 9RG. (081–534–1198 evenings)
Atomwide Ltd	23 The Greenway, Orpington, Kent, BR5 2AY. (0689–38852)
Beebug	117 Hatfield Road, St Albans, Herts, AL1 4JS. (0727–40303) *(–60263)*
Clares Micro Supplies	98 Middlewich Road, Rudheath, Northwich, Cheshire, CW9 7DA. (0606–48511) *(–48512)*
Colton Software (p30)	149-151 St Neots Road, Hardwick, Cambridge, CB3 7QJ. (0954–211472) *(–211607)*
Computer Concepts (p28/29)	Gaddesden Place, Hemel Hempstead, Herts, HP2 6EX. (0442–63933) *(–231632)*
Computerware	11 Livestock Market, Hall Road, Norwich. (0603–507799)
Dabs Press	22 Warwick Street, Prestwich, Manchester, M25 7HN. (061–773–8632) *(773–8290)*
David Pilling	P.O.Box 22, Thornton Cleveleys, Blackpool, FY5 1LR
Electronic Font Foundry	Bridge House, 18 Brockenhurst Road, Ascot, SL5 9DL. (0990–28698)
ECD Computers B.V.	Voldersgracht 25_26, 2611 EV Delft, Holland.
EMR Ltd	14 Mount Close, Wickford, Essex, SS11 8HG. (0702–335747)
Future Software	10 Stokesay, Bidston, Birkenhead, L43 7PU.
Ground Control	4 Alfreda Avenue, Hullbridge, Essex, SS5 6LT. (0702–230324)
Ian Copestake Software (p6)	10 Frost Drive, Wirral, L61 4XL. (051–648–6287)
LCI Software	Wood Farm, Hatley St George, Sandy, Beds. SG19 3HJ.
Lingenuity (Lindis) (p20)	P.O.Box 10, Halesworth, Suffolk, IP19 0DX. (0986–85–476) *(–460)*
Longman-Logotron	Dales Brewery, Gwydir Street, Cambridge, CB1 2LJ. (0223–323656) *(–460208)*
Microvitec plc	Bolling Road, Bradford, BD4 7TU. (0274–390011) *(–734944)*
Minerva Systems	Minerva House, Baring Crescent, Exeter, EX1 1TL. (0392–437756) *(–421762)*
Morley Electronics	Morley House, Norham Road, North Shields, Tyne & Wear, NE29 7TY. (091–257–6355) *(–6373)*
Northern Micromedia	Resources Centre, Coach Lane Campus, Newcastle upon Tyne, NE7 7XA. (091–270–0424)
Oak Computers (p10)	Cross Park House, Low Green, Rawdon, Leeds, LS19 6HA. (0532–502615) *(–506868)*
Passkey Marketing	P.O.Box 649, Shenley Lodge, Milton Keynes, MK5 7AX. (0908–669879)
Protokote Ltd (p16)	Unit 5, Water Lane Trading Estate, Storrington, West Sussex, RH20 3DW. (0903–743358) *(–746325)*
Safesell Exhibitions (p19)	Market House, Cross Road, Tadworth, Surrey KT20 5SR.
Sherston Software	Swan Barton, Sherston, Malmesbury, Wilts. SN16 0LH. (0666–840433)
Silicon Vision Ltd (p8)	Signal House, Lyon Road, Harrow, Middlesex, HA1 2AG. (081–422–2274) *(–427–5169)*
Soft Rock Software	124 Marissal Road, Henbury, Bristol, BS10 7NP. (0272–503639 evenings)
Software Solutions	Broadway House, 149-151 St Neots Road, Hardwick, Cambridge, CB3 7QJ. (0954-211760)
SPEM	Via Aosta 86, 10154 Torino, Italy. (Fax 010–39–11–280009)
Superior Software	Regent House, Skinner Lane, Leeds, LS7 1AX. (0532–459453)
Video Electronics Ltd	Wigan Road, Atherton, Manchester, M29 0RH. (0942–882332)
Watford Electronics	250 Lower High Street, Watford, WD1 2AN. (0923–37774) *(0923–33642)*

Norwich Computer Services 18 Mile End Road, Norwich, NR4 7QY. (0603-507057) *(Fax 250095)*